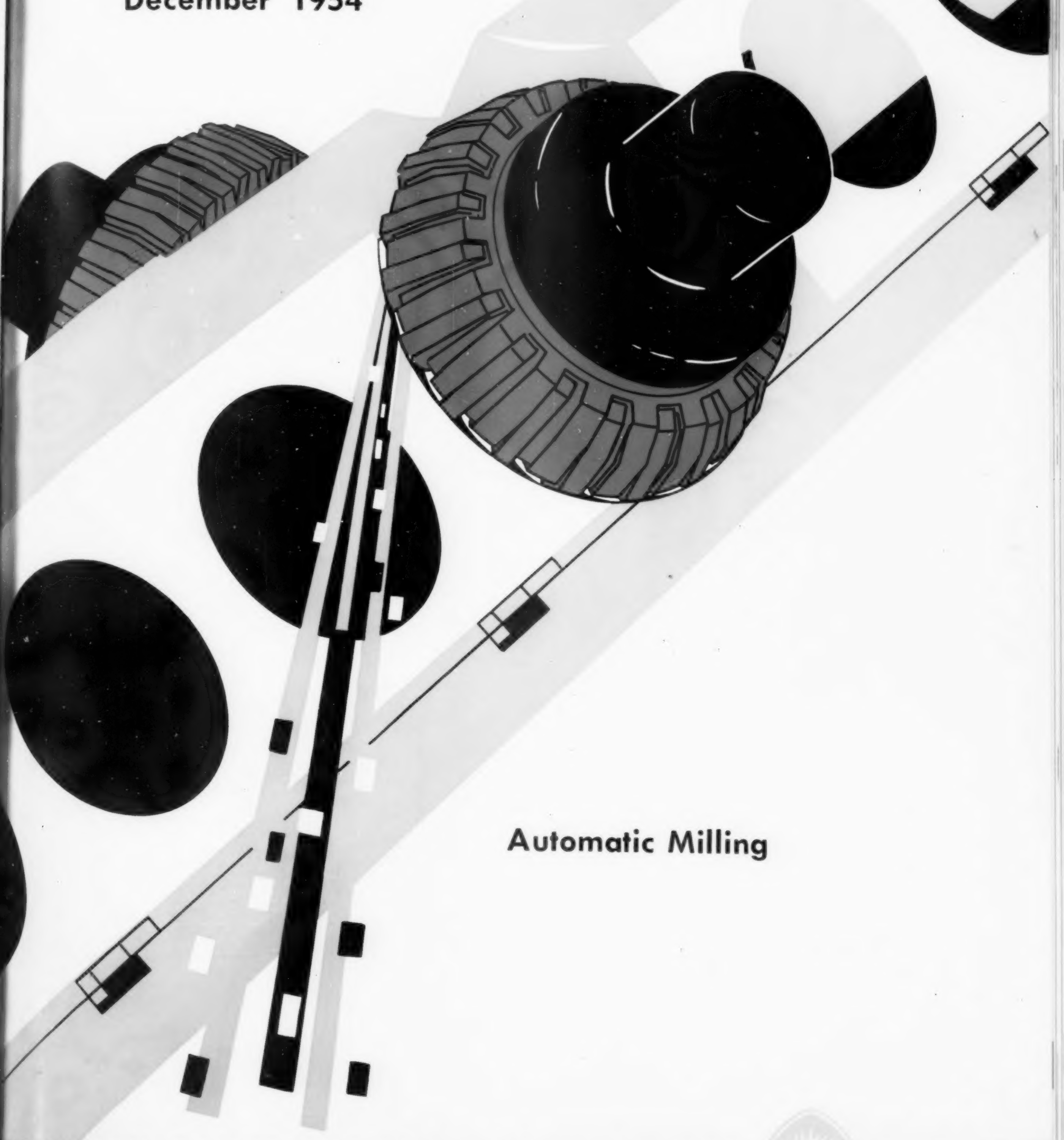
THE TOOL ENGINEER

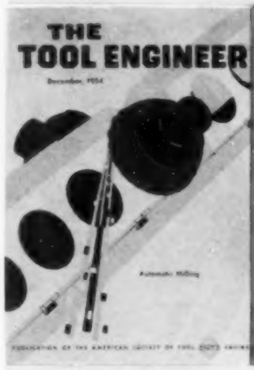
December 1954



Automatic Milling

UBLICATION OF THE AMERICAN SOCIETY OF TOOL ASTE ENGINEERS

Cover: Milling is one of the important production operations incorporated in the new Pontiac engine line. The tremendous job of tooling an entire plant with automation equipment from scratch is described in the article beginning on page 109, along with the basic manufacturing philosophy behind this dramatic modernization.



The Tool Engineer

Volume XXXIII, No. 6 **December 1954**

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PLANNING · ENGINEERING · CONTROL · TOOLING · EQUIPMENT · PRODUCTION

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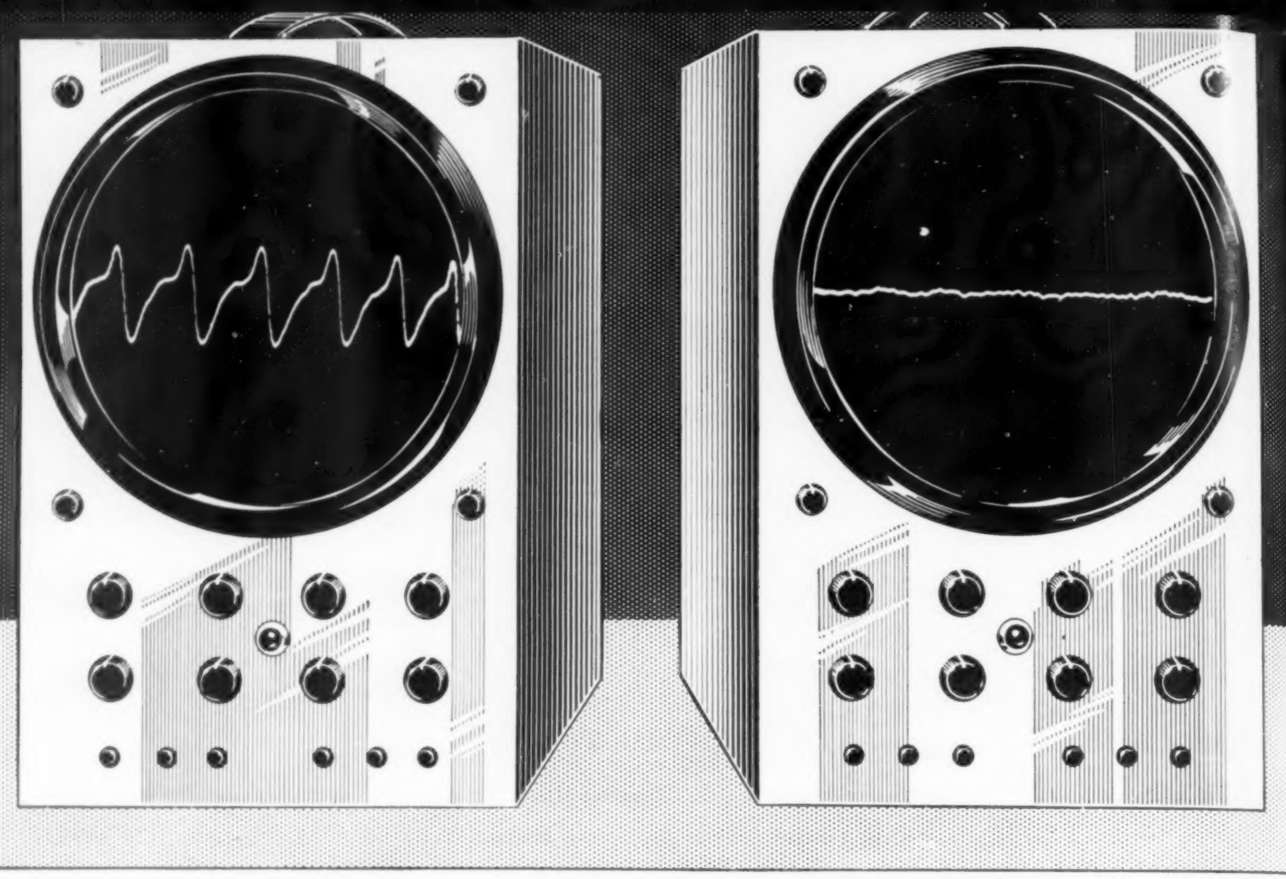

THE TOOL ENGINEER

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The Tool Engineer

Business for Tomorrow

You cannot build today's products with yesterday's machines and be in business tomorrow. This thought was expressed by Dr. Gilbert of General Electric at the recent Machine Tool Distributors meeting in Cincinnati. In spite of the general acceptance of this philosophy, many manufacturers are not aware of the insidious character of obsolescence and of the extravagant folly of keeping outdated machines in production.

A production machine does not become obsolete merely because of its age but does become outdated when developments and improvements make previous models uneconomical to operate. Spurred by good old-fashioned competition, machine tool builders are incorporating improvements to the extent that tool engineers should analyze each new machine with respect to potential application in his plant. Those who have not followed this practice will be surprised at the savings that can be effected with new equipment. Quicker setup, shorter machine cycles, simplified and more accurate controls, better features for loading and unloading, increased horsepower, and more automatic operation may be found in these machines.

Because of the importance of the features that are available in new machines, some manufacturing plants have set up positive programs to keep production at efficient levels. Noteworthy in this respect is the program of Ingersoll Milling Co. Annually, its shop must justify to management the use of all machines that have been in operation for more than ten years. With such a program obsolescence cannot be damaging to production.

With the best equipment to make a better product at a lower cost, the tool engineer can assure business for tomorrow.

John W Greve
EDITOR


EFFECTIVE-
EFFICIENT*
aye, and ECONOMICAL,
too!
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Dial Snap Gages
With a remarkable new type of pin locking mechanism that minimizes "out-of-parallelism" between anvil faces. "L" Type fully encased, with set-back indicator and handle, permitting entry into narrow recesses. Wide choice of indicators as for "D" Type.
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cover range from
1/8" to 24"
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Dializers®
STANDARD's original device for converting AGD Adjustable Limit Snap Gages to DIAL Snap Gages. Wide range of indicators from 1⅛" to 2¼" diameter, graduations of .001", .0001", .0005" and .00025", and a wide variety of dial markings, including metric.
Available separately for your frames or assembled in AGD frames supplied by us.
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A complete range of sizes and mountings, with any desired graduation; regular, metric or Decimatic . . . all completely shockproof.
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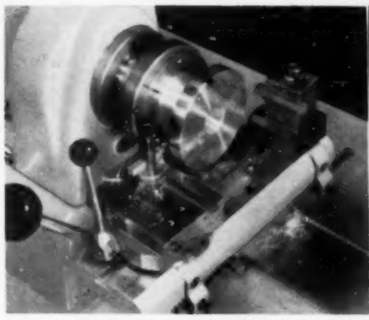
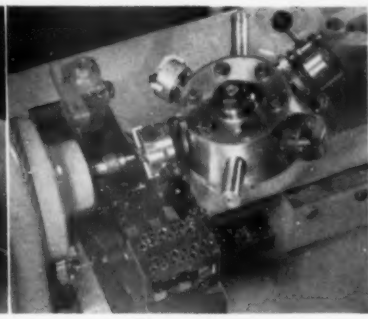
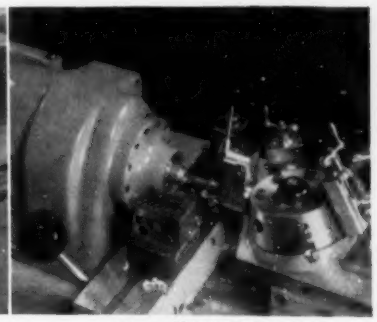
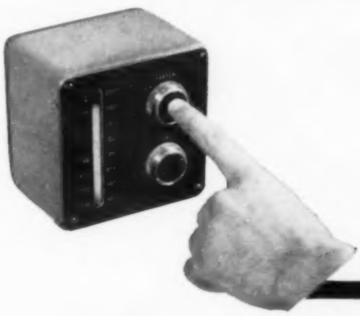

Large Work


Threading


Small Work



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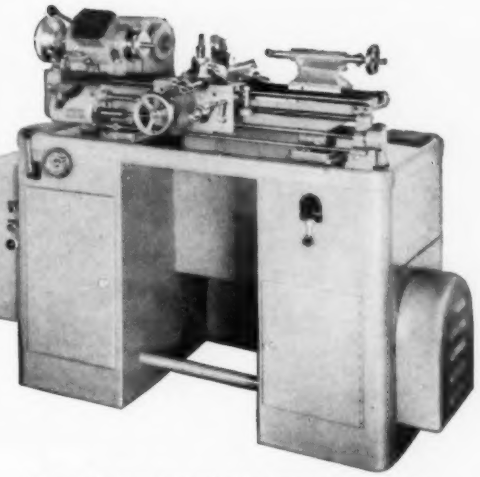


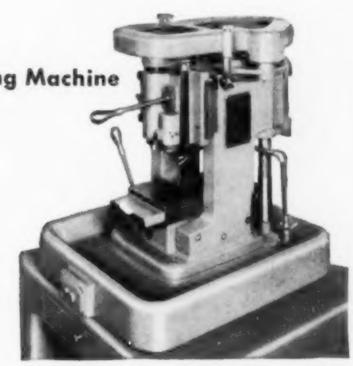
No. 8A Tool Maker's Precision Lathe

A variable speed feed for the feed rod is available as optional equipment. It provides an independent powered longitudinal or cross feed which permits the operator to change the rate of feed while the tool is under cut to secure the desired work finish during turning, facing or boring operations. The rate of feed for variable speed feed is controlled by a potentiometer.

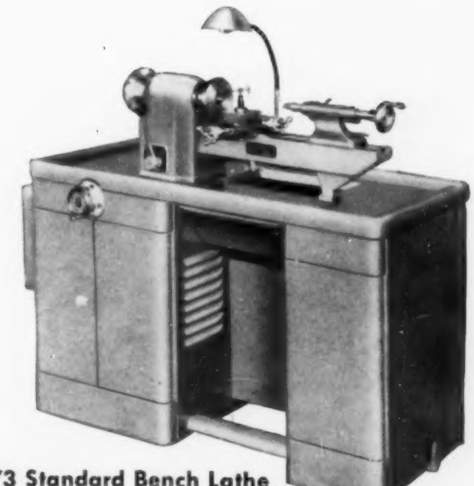
...you can make money with these 4 Wade precision machines

To keep pace with your competition, you need the latest, *most efficient* production machines you can buy. Here are four that are remarkably accurate — designed and built throughout for precision work to close tolerances. Some of the features on each machine are patented and exclusive. All machines are carefully described in Bulletins, available on request.

Hand Profiling Machine



No. 73 Hand Screw Machine



No. 73 Standard Bench Lathe

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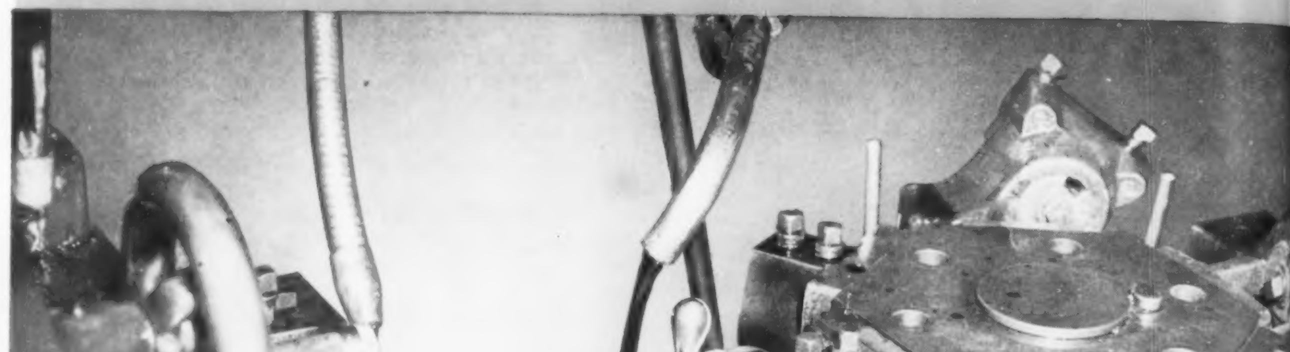

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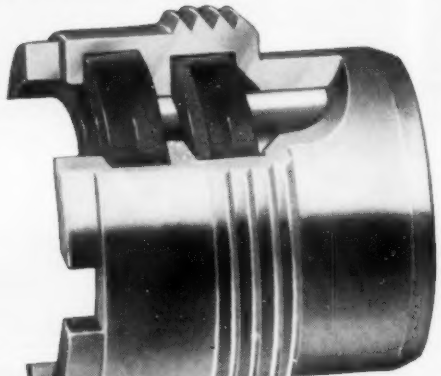
...externally removable and replaceable without dismantling cylinder!



Here's the biggest improvement in cylinder design in the last 50 years. This exclusive Hannifin gland is a bronze cartridge, externally removable and replaceable as a unit to meet J.I.C. recommendations. A face type spanner wrench is the only tool you need. Now look at the packing! The "Wiperseal" serves a dual purpose as it wipes both ways to provide a dry rod on the out-stroke, a dirt-free rod on the in-stroke. The "Lipseal" is self-compensating, self-relieving and non-adjustable... provides an efficient seal throughout its long life. Ask for a demonstration... every Hannifin man carries a cutaway sample of this "jewel" of a gland with him at all times.

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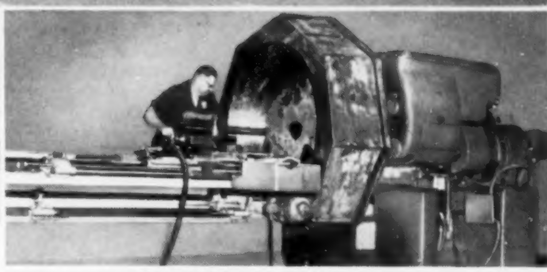
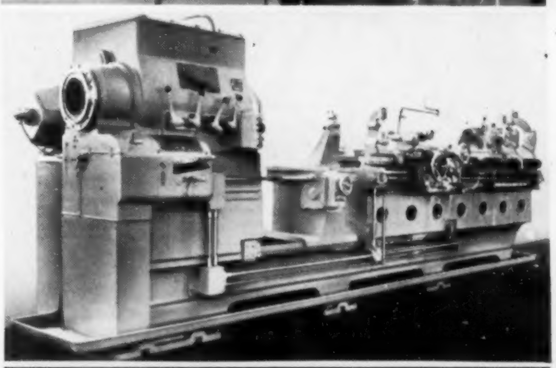
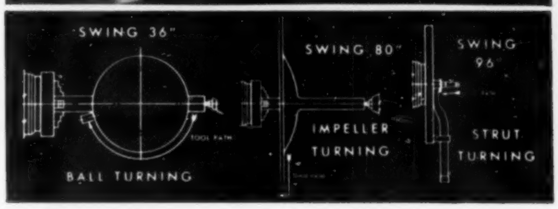
is the Navy's and Marine Corps' standard attack bomber—used extensively in the Korean War.



15,485 LB. HAMMER DIE MACHINED ON AXELSON 100" GAP BED LATHE





Turning large contour work and odd shapes such as aircraft landing struts are machining problems that are easily handled on Axelson Gap Bed Lathes.

This particular lathe is machining a 15,485 lb. hammer die for forming the cowling for Douglas AD-5 and AD-6 "Skyraiders." The Axelson ball turning attachment permits the I.D. to be finish machined to a template, turn a radius on the bottom, after which the bottom is faced. Note the entire weight of the die is mounted on the spindle without tailstock support.

The machine is powered with a 30 H.P., D.C. motor with electronic control that permits infinite speed changes from 0.4 to 308 R.P.M. Motors up to 75 H.P. may be supplied for heavier work when required.

Similar machines equipped with standard Axelson attachments are finding applications in heavy industry for machining large irregular shaped parts, in the maritime industry for turning turbine rotor blades with integral shafts, and in the oil industry for turning heavy oil well equipment. There is no limit to the application of Axelson Heavy Duty Lathes for they serve all industries.

It will pay you to consider Axelson for solving your heavy duty turning problems economically. Call our qualified distributor in your locality or write direct to the factory for recommendations. Your request for assistance is without obligation.

Write for literature describing Axelson Heavy Duty Lathes, Models 16", 20W", 20", 25", 32"; Precision Tool Room Lathe Models 16", 20"; Gap Bed Lathes 25"/100", 25"/125" or Special Machines.
6146 BOYLE AVE., LOS ANGELES 58, CALIF.

MACHINE FACTS

- Machine—Axelson 100" Gap Bed Lathe
- Swing Over Ways, Gap Closed—34½"
- Swing Over Ways, Gap Open—100"
- Spindle Bore: 11" Diameter
- Spindle Speed Ranger: 0.4 to 308 RPM
- Electronic Control provides infinite speed changes
- Ball Turning Attachment: 9" to 36" Dia.
- Distance Between Centers, Gap Closed: 144"
- Distance Between Centers, Gap Open: 216" Max.
- Machine Weight: 60,000 Lbs.
- Note: For large work motors up to 75 H.P. can be supplied.

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Five Sizes to Suit Space and Visibility Requirements. Over Eighty Different Models Available — All Federal Regular Type Indicators except "A" Size, are made to A.G.D. specifications. The five sizes are respectively: A — 1¼", B — 1¹¹⁄₁₆", C — 2¼", D — 2¾" and E — 3⅝" dia.

Testmasters — Universal Test Indicators — Federal's Testmasters are the most copied Test Indicators in both this country and abroad. But they surpass all attempts at imitation in *accuracy, durability* and *adaptability.* Graduated .001" and .0001" and in .0025MM and .01MM.

A Non-Magnetic Testmaster is a new item which is especially advantageous to use around magnetic chucks.

Graduations To Suit Tolerance — Dials in all Indicator sizes available graduated .00005", .00025", .0001", .0005", or .001", and Metric. Dials can be Balanced (plus and minus) Dials, graduated for regular tolerance comparison, or Continuous Reading (graduations numbered continuously) for direct measuring such as thickness, depth, etc. Continuous Reading Dials regularly furnished with Revolution Counter to facilitate reading total measurement. Special dials also furnished.

Perpendicular Indicators. Two Sizes, Seven Graduations — Specially adapted to fixtures where the movement of the contact point must be at right angles to the Dial. This Indicator is the first to use a crown gear movement to reduce friction to a minimum and is a smooth running, sensitive and very accurate instrument. Indicators of this type are available with Regular and Cushion Movements.

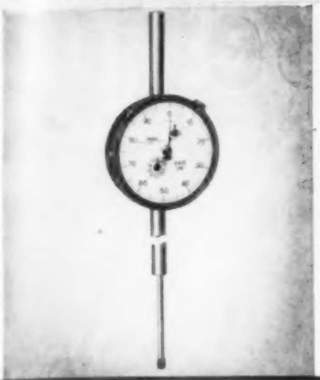
Cushion Movement Indicators — Federal offers a cushioned movement *optionally* on nearly all Regular Type Federal Dial Indicators. Many users prefer a directly geared movement where conditions require top accuracy. The Cushion Movement absorbs impact and prevents shock from reaching and damaging the small gear teeth, jewels, pivots and other parts. There is no increase in contact pressure or friction. Rigorous tests prove the exceptional stamina of this Movement.

Super-Sensitive Indicators — All Bushing Friction Eliminated — The movement is entirely enclosed — dust and dirt cannot enter. All jewels are the highest grade carefully polished sapphire. Contact travel is limited to a short range for greatest accuracy, yet is sufficient for the precise measurements required of the Indicator. It is designed for those who desire the utmost in accuracy.

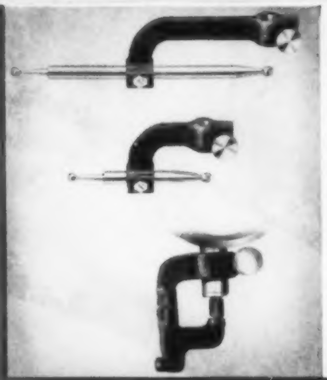
Dial Indicator, Air, Electric, or Electronic Gages —— for Inspecting,

Want From This Line

Why Federal Outsells All Others



Long Range Indicators—These Federal Dial Indicators have longer ranges than the regular A.G.D. Models. They can be had in practically any length but those regularly provided have a range of .020" graduated .0001". And ranges of .100" and 2" graduated .001". All are 2¾" diam. or the regular "D" size Indicator. Revolution Counters are always furnished with Long Range Indicators to count off each revolution of the Indicator Hand.



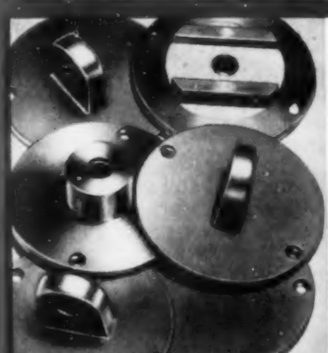
Attachments — Hole Attachments facilitate testing internal and other surfaces inaccessible to the regular Indicator spindle. They fit Indicators with .275" or .375" stems. Right Angle Offset Attachment transfers motion at right angles to the Indicator spindle, directly to the Indicator. Arm is hinged by a flat spring, eliminating inaccuracies caused by wear or play in pivot-type bearings. This Attachment fits all Indicators with a .375" stem.

Long Stem Indicators—Recesses and similar places impossible to reach with regular Indicators are accessible to these Indicators. Stems of various lengths can be furnished to meet specific requirements. These Indicators are special and details of your requirements are needed with your order.

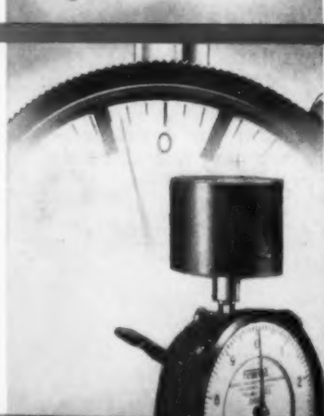
Contact Points — Federal Contact Points in any lengths varying by ⅛" are hardened steel and blackened to retard rusting. Several shapes and sizes are available. Wide Face Points of hardened and ground steel can be used when desired in place of Regular Contact Points. Special Points can also be furnished. Where Indicator Contacts are subject to excessive wear, Points can be furnished tipped with diamond, tungsten carbide, or hard chromium plate.

Lifting Lever — New, free acting. Does not affect the reading or accuracy of the Indicator and is furnished on regular bracket type back. Can be furnished to order on any other type of back. It can also be supplied separately assembled to a replacement back for use on existing "exposed" type Indicators.

Dust Guards — Keep out talc, dust, excessive oil, etc. Used on regular type points.



Backs — The Regular Type Back is standard with Federal Regular Type Indicators and is included in the price of the Indicator. Other Backs can also be furnished; with offset bracket, post bracket, screw bracket, adjustable bracket, and flat. Special Backs to meet customer's requirements can also be furnished to order.



Tolerance Hands — These Hands mark specified limits of any dimension. They can be set independently by rotating the knurled bezels and clamped in position. They do not interfere with setting Dial.

Weights — Compressible materials such as rubber, paper, textiles, etc., should be measured under constant pressure (not spring loaded). Federal provides weights, to conform with technical society standards. Pressure is directly through the rack spindle to the contact point.

Ask **FEDERAL** ***FOR ANYTHING IN DIMENSIONAL DIAL INDICATORS.*** — **If necessary, we could readily provide over a thousand combinations of our existing gears to make Federal Dial Indicators having every imaginable range and graduation. It's the most extensive line of Dimensional Dial Indicators in the world. Ask for your copy of the Federal catalog showing this most complete line.**

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*Watch for other reasons in later advertisements

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ALLENPOINT SET SCREWS Proved 5 Ways Better

Tested by a prominent independent laboratory against standard cup point and serrated point set screws, Allenpoint socket screws topped them all. In every test — carefully set up to simulate actual installations — Allenpoints outperformed and outlasted competing set screws.

BETTER *Cup Point Pattern*

Allenpoints make the all-important full circle pattern when tightened up to *ordinary* pressure — the normal force exerted to tighten a socket screw by hand.

BETTER *Resistance to Rotation*

Deep driven Allenpoints hold longer under increasing torsional strain than any other set screw tested.

BETTER *Cup Point Depth*

The deeper they drive the tighter they hold. Allenpoints — again at average wrenching pressure — penetrate smoothly and deeply with no gouging, no cutting action.

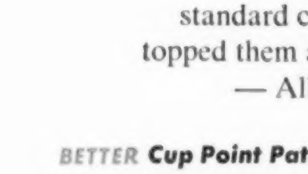
BETTER *Resistance to Longitudinal Thrust*

Tighten an Allenpoint held collar to a shaft with a wrenching pressure of only 150 inch pounds. It will take 1200 lbs. of longitudinal thrust to start that collar along the shaft. No pipe extension, no twisted wrenches to get effective tightening pressure. Allenpoints hold tightly at average *hand wrenching* pressure.

BETTER *at Withstanding Vibration*

Long after other set screws loosen their grip, Allenpoints hold firm under repeated vibration.

Write our Advertising Department for a detailed, technical brochure on these comparative tests. It's got the facts on the Allenpoint story.



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Hartford 2, Connecticut, U. S. A.

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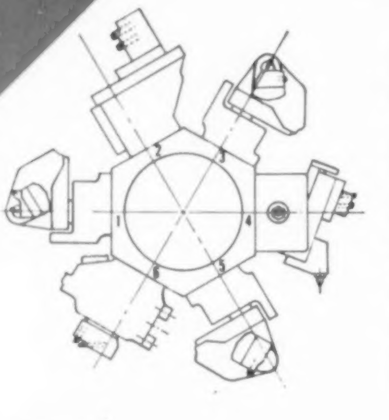
SINGLE-TOOL WORK PUT "ON THE DOUBLE"

Unique Fastermatic setup generates radii with swinging tools



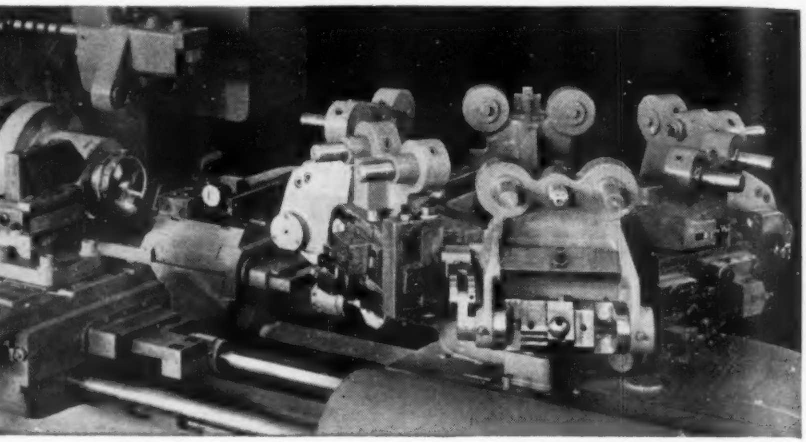
Only single-tool or generated cuts could achieve the accuracy and finish required for the seat faces and snap-fit diameters on these parts for water meter chambers. Note how the problem is solved by two Gisholt 1F Fastermatic Automatic Turret Lathes with a unique tooling setup. Nickel-iron workpieces come to the machines with reverse sides machined, drilled and bolted on chucking plates.

Here's the operational sequence:

Turret 1—Generate radii F and H.
Turret 2—Rough and finish turn C.
Turret 3—Burnish radius H and break corner K.
Turret 4—Finish face G and chamfer J with angular mounted slide tool and turret facing attachment.
Turret 5—Finish generate radius F.
Turret 6—Finish face D and E.
Front C/S—(Not shown on drawing)—Finish face A, semifinish face D and chamfer B.

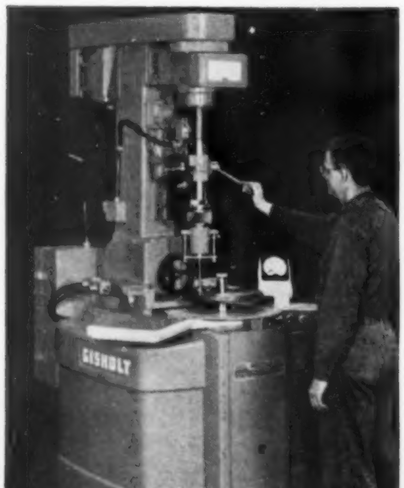
One man and two Fastermatics with single-point tooling produce 320 parts per 8-hour day with this novel setup—12% better output than former way.

Special radius generating tooling on hexagon turret stations.



BALANCING AND CORRECTION COMBINED IN ONE HANDLING

Built-in Drill Spindle Speeds Output of Gisholt DYNETRIC Balancer



The design of the improved Gisholt 1SV1 Static Balancer easily permits the addition of correction equipment, such as drill spindles and welders. This makes production balancing simpler, faster and less expensive than ever.

Note how this well-known manufacturer is balancing flywheels. The cast iron parts are held on an expanding arbor and rotated. The operator notes the angle and amount of unbalance. The amount is indicated in terms of drill depth on the direct-reading meter located conveniently beside the work and the angular location is indicated by the number observed on a dial under a stroboscopic lamp.

Stopping the machine, the operator indexes the part for correction drilling at the location specified. Movement of the feed lever brings a thrust support under the workpiece and starts the drill. The vacuum chip remover comes down with the drill, removing the chips as they are formed. When the reading on the drill depth dial corresponds with the indicated amount of unbalance, the drilling is stopped.

In this efficient setup for measuring, locating and correcting unbalance in one chucking, output is at the rate of 53 parts per hour at 80% efficiency.

DYNETRIC BALANCERS

Ask for information on courses offered by *Gisholt Balancing School.*

NEW PROFITS...MODERNIZE NOW!

TIME-SAVING IDEAS

CONTOUR BORING ON FIXED CENTER TURRET LATHE?

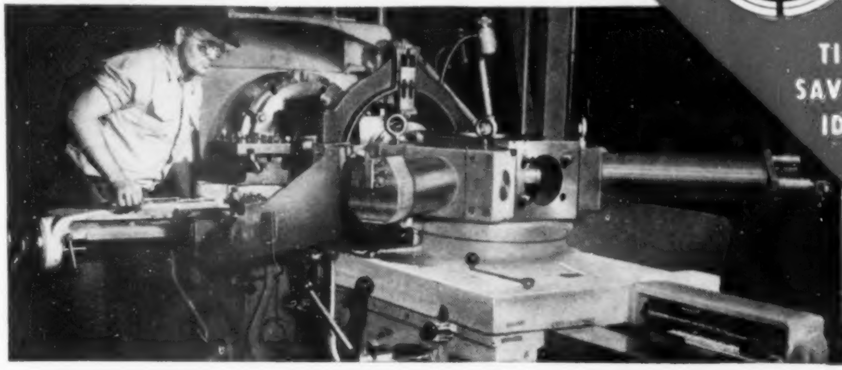
Special tooling and cam plate show the way

This workpiece is large, awkward and unwieldy. It's a gun recoil mechanism cradle assembly—28" long by 19½" in diameter.

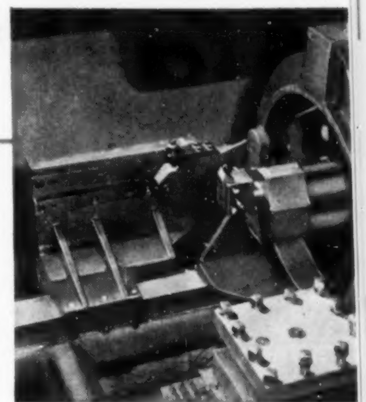
The job starts with the bore being chamfered from the square turret. A live center supports from the hexagon turret while square turret tools face the end and turn the O.D. Then a steadyrest is moved to support the part on the machined O.D. and the end is finish faced from the square turret.

Of special interest is the method for final contour boring achieved by a cam plate mounted on the rear bedway. A special trunnion, with one arm carrying the cam follower and the other carrying the boring bar and tool, pivots through the hexagon turret mounting. The boring tool alternately raises and lowers with the cam as the hexagon turret carriage feeds in toward the headstock.

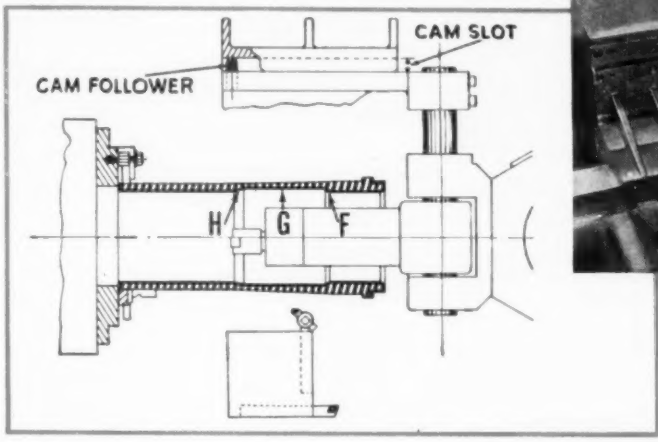
In this novel setup, accurate contour boring is easily accomplished by a cam-guided tool on this fixed center hexagon turret lathe.



Close-up shows angle plate on bedway and cam arrangement for guiding boring bar on fixed center turret lathe.

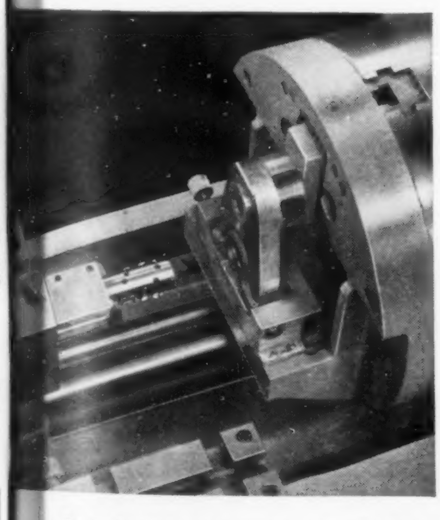


Contour F-G-H handled with special cam attachment. Other surfaces machined in conventional manner.



A FIRST-RATE JOB OF HOLDING AND MACHINING

Quick Changeover for Five Sizes Keynotes No. 12 Hydraulic Job

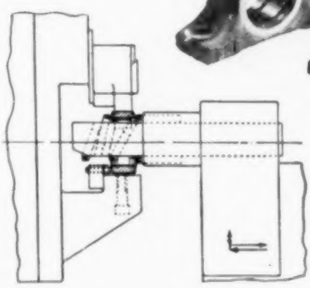


Single floating jaw in counter-balanced chucking fixture works for five sizes.

How to set up for simple, speedy machining and changeover for various size parts is nicely illustrated here.

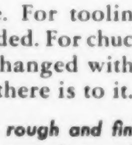
This Gisholt No. 12 Hydraulic Automatic Lathe handles all production requirements for five sizes of cast iron pillow blocks. Holding is provided for by a special fixture mounted in a standard 3-jaw air chuck. Clamping pressure is applied to the feet, thus eliminating any distortion.

A single boring bar held in the front carriage does rough and finish boring and chamfering with longitudinal movement and then straddle faces, cuts snap ring grooves and chamfers with transverse movement. No tool marks left in the bore this way. Part sizes vary from 1.378" to 2.440" in the bore and time ranges from 1.3 to 1.9 minutes f.t.f.



Changeover is simple. For tooling, a new boring bar is added. For chucking, the centerline is changed with a riser plate. That's all there is to it.

A good example of how rough and finish machining of various size parts is speeded with separately tooled, easily changed boring bars.



TALK TO GISHOLT ABOUT MACHINE TOOL LEASING

TIME-SAVING IDEAS

3-IN-1 SETUP SAVES EXTRA OPERATIONS

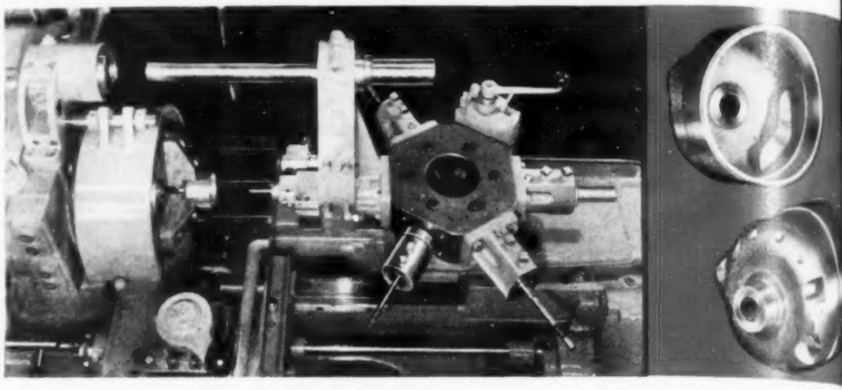
Machining, Broaching, Pressing Done on One Machine

Whenever you can combine three operations in one, you're time and money ahead. One such "how-to-do-it" is illustrated here... in the production of these fractional horsepower electric motor housings.

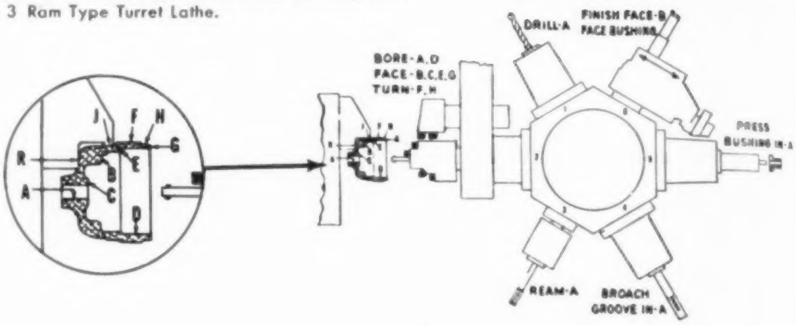
Instead of machining and then broaching a locking groove and then pressing in a bushing—as separate operations—this Gisholt No. 3 Ram Type Turret Lathe is expertly tooled to perform the *entire* job.

The layout shows how tools on the hexagon turret, in addition to standard machining, broach the groove and press in a bushing—all in one chucking. To complete the operation, the bushing and the housing are both finish faced from the last hexagon turret face. Time is only 1.37 minutes.

By skillfully doubling up operations on one machine, this producer eliminated a great deal of rehandling, saved real time and money in production.

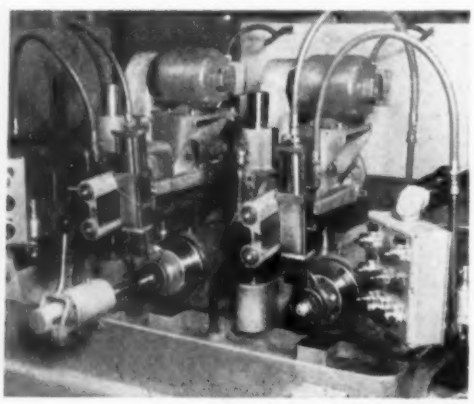


One machine does work of three with this setup on a No. 3 Ram Type Turret Lathe.



PARTS SUPERFINISHED AT RATE OF 140 PER HOUR

One operator tends two-spindle machine



Showing setup of Gisholt Two-Spindle Superfinisher, with push-button control panels for each station.

This European manufacturer had the problem of Superfinishing four different transmission parts, including a gear and shaft assembly plus three similar gear parts as shown. The requirement was for high production and, naturally, for the most economical method.

The practical solution was worked out by Gisholt engineers using this No. 54 Two-Spindle High Production Superfinisher. Since both stations have a fully automatic machine cycle, only one operator is needed to load and unload parts, alternating between stations. Note that each station has its own separate push-button control panel so that after loading, the operator merely engages the cycle start button.

The left-hand spindle station is in continuous production on gear and shaft assemblies. The right-hand station has tooling setup changes for the 3 other gear parts. On all workpieces, Superfinish is performed on a 7 degree tapered surface on the back-rim I.D. Surface reading of from 25 to 30 micro-inches is reduced by Superfinishing to 4 micro-inches or less. With floor-to-floor time of only 35 seconds per part, total production is 140 parts per hour at 80% efficiency.

With this high-production setup, one machine and one operator handle a variety of parts to easily meet production requirements—and with real economy.

Arrows indicate surfaces Superfinished on transmission gear parts.

No. 11-1254

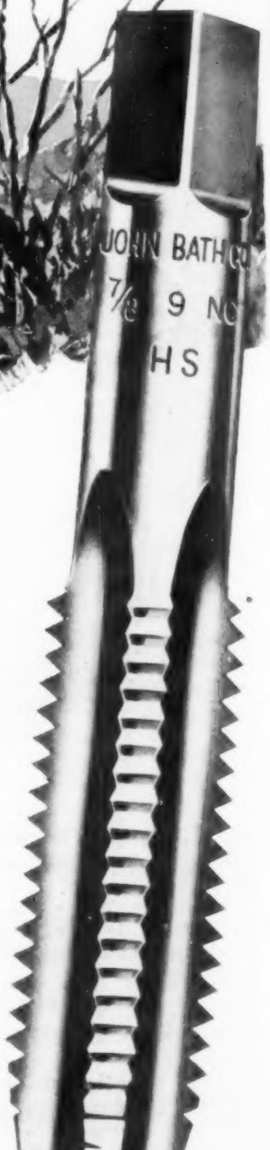
631

THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

GISHOLT

MACHINE COMPANY Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES



"KNOW HOW"

The ability of a bird dog to flush a pheasant, to retrieve and to follow the basic rules of the "point" . . . is the result of natural aptitude, training and experience — qualities that combine to form the priceless ingredient called "know how".

At the Bath plant, these same qualities — natural aptitude, training and experience — provide the basic "know how" of Bath craftsmen who are responsible for the design and manufacture of Bath taps and gages.

Tap design problems are first worked out on the drawing board, to take final shape in taps that meet the demand for working all metals and to overcome unusual conditions. This takes knowledge of a specialized nature.

Research and laboratory experiment is a constant aid to improvement in the manufacture of taps, to maintain the high standard of Bath tap performance and dependability. Here, the natural aptitude, training and experience of Bath personnel, pays off.

When a stubborn threading problem confronts you — rely on Bath "know how" for helpful assistance and advice.

Bath engineers check every detail, to see that all Bath Taps are conditioned to do the best threading job for your requirements.

Insist on BATH TAPS for BETTER THREADS

JOHN BATH & CO., Inc.

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PLUG CYLINDRICAL AND THREAD GAGES • RING THREAD GAGES • GROUND THREAD TAPS • INTERNAL MICROMETERS

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something new

in **BROACHING**

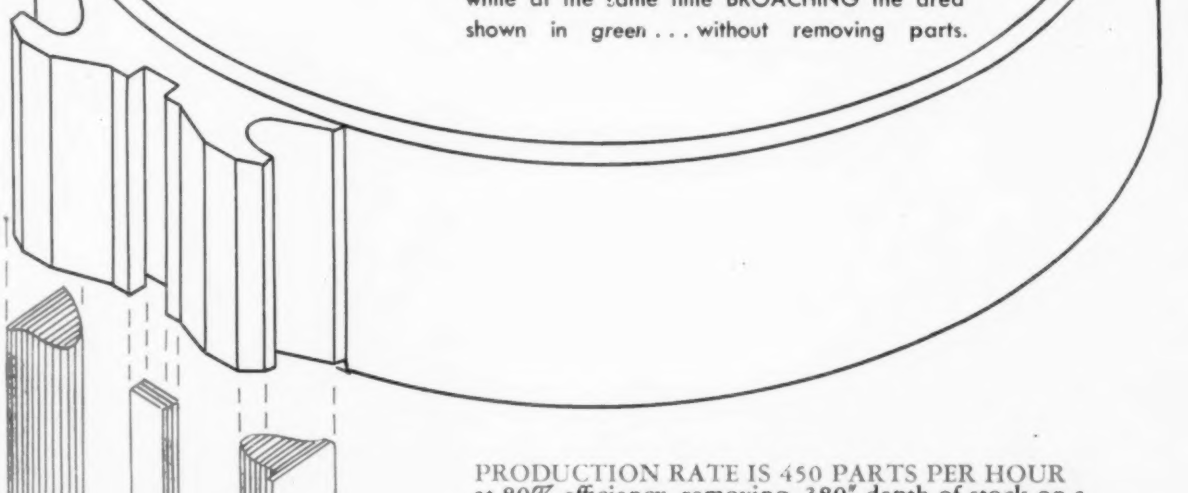
this LAPOINTE

10-Ton
54-inch Stroke

double ram VERTICAL BROACHING MACHINE

is designed to EXPAND TRANSMISSION BAND ASSEMBLIES

3/16" in circumference, to true size and diameter, while at the same time BROACHING the area shown in *green* . . . without removing parts.



After the lining has been bonded onto the bands, they are cut apart on another LAPOINTE machine which also chamfers the lining.

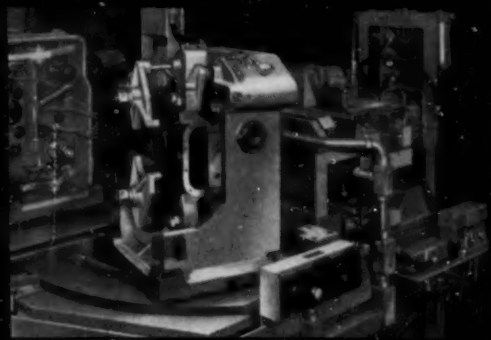
PRODUCTION RATE IS 450 PARTS PER HOUR at 80% efficiency, removing .380" depth of stock on a surface. Fully push-button controlled — the operator needs only to load and unload the parts!

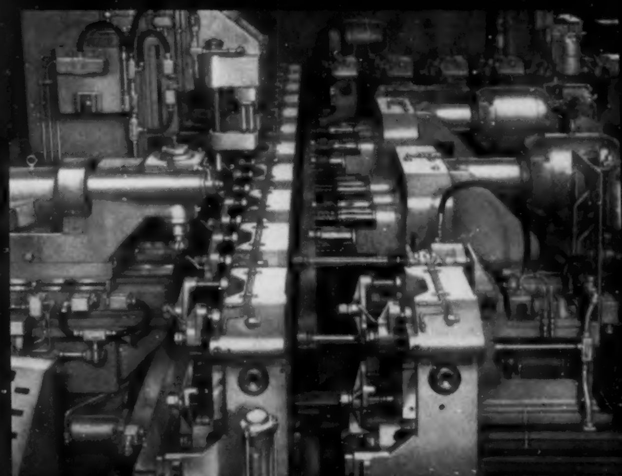
You can always keep up with the newest in broaching techniques, when you call on LAPOINTE! That's to be expected, because we've been engineering and building *broaching machines, tools and fixtures* for more than 52 years.

If you want more information about the job described above, write for Bulletin TBA-DRV-5

THE LAPOINTE MACHINE TOOL COMPANY
HUDSON, MASSACHUSETTS • U. S. A.
In England: Watford, Hertfordshire

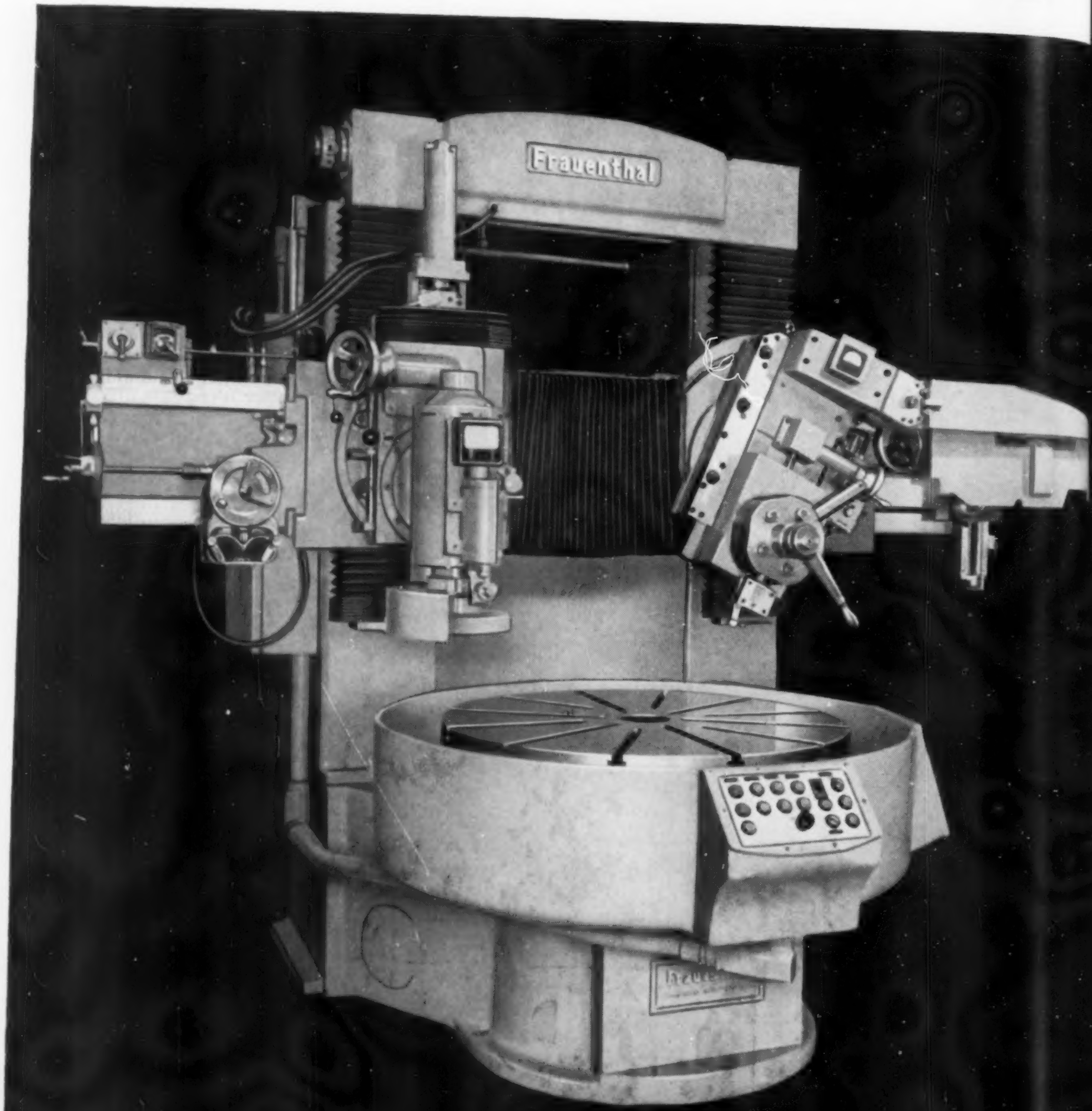
THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES





CAN YOU

to .000200" accuracy



turn, bore and grind in a single set-up?

The Frauenthal 3100 Series offers this precision and versatility with these cost-cutting features

1. Utmost versatility — Both grinding compound and turret slide can be swiveled to meet practically any angular requirement.

2. Super-precision performance — Only a Frauenthal grinds related surfaces to accuracies within .000200″, producing consistently uniform precision in concentricity, parallelism and roundness.

3. Horizontal table — Loads easier and faster than vertical face plates. Horizontal table also provides greater stability for large, heavy parts.

4. Simplified tooling — Horizontal table permits simpler fixtures, particularly for thin-section jet engine parts, plus economy of dual purpose tooling for turning and grinding.

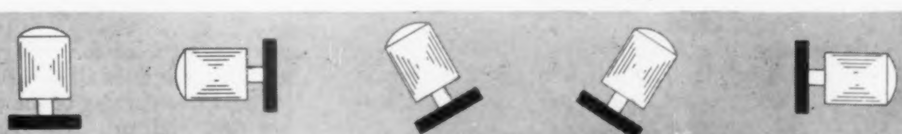
5. Convenient controls — All operating controls are easily within the operator's reach for quick selection of feeds and speeds. Electrical interlocks are provided for utmost safety.

6. Contour turning — Hydraulic duplicator attachment (turning head) performs tracer controlled turning operations most accurately and performs repetitive operations at lower cost.

May we help you?

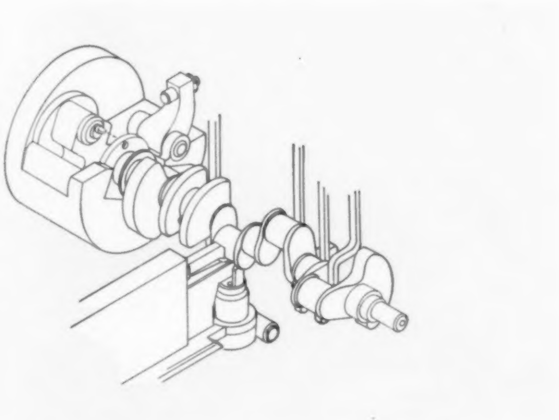
If you'd like further information on how the 3100 Series precision turning and grinding machine can give you production and/or tool room advantages — our engineers are at your service. Write for informative bulletin No. 301.

Your choice of five positions of the grinding spindle



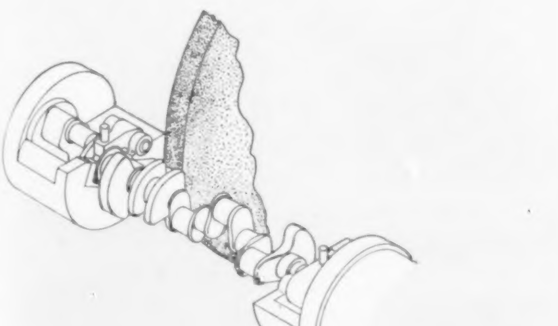
Frauenthal Division · KAYDON ENGINEERING CORP. · Muskegon, Michigan

4-way automation in new Norton machine



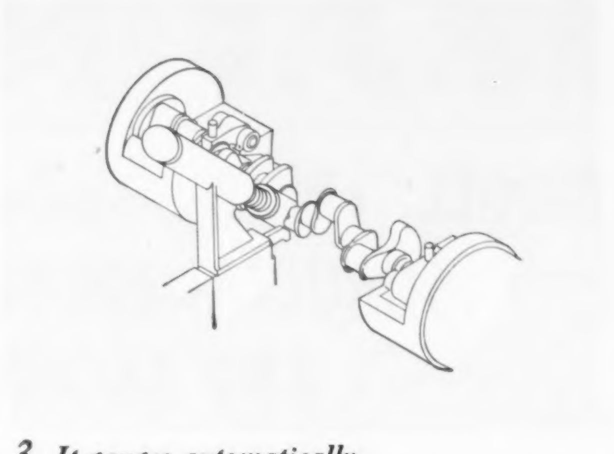
1. It adjusts automatically

Norton Automation locates the work in the grinder both angularly and longitudinally by built-in mechanism . . . grinding wheels are trued automatically . . . automatic compensation for reduction in wheel diameter is made by the feeding mechanism.



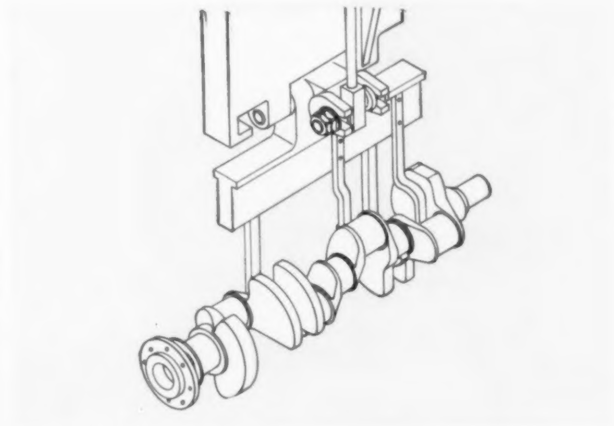
2. It grinds automatically

Being completely automatic, the grinders operate close to 100% efficiency all the working day. They can be pre-set to operate at a definite rate of production continuously. The unit can be controlled, when necessary, to by-pass any inoperative station.



3. It gauges automatically

Spark-out and work size are controlled by an electric gauge which contacts the work during grinding and automatically terminates the cycle by retracting the wheel slide when size is reached.



4. It transfers automatically

Five transfer units travel vertically to pick up and deposit the crankshafts at each station, moving simultaneously. These units are joined together, moving in unison horizontally to transfer the work between stations. The final unit carries ground crankshafts out of transfer machine.

New Automated Grinders Soon to Come . . .

This crankpin grinder is only one of many Norton advances in Automation. For more information about this and other Norton Automated Grinders, write Norton or see your Norton representative. And remember: only Norton offers you such long experience in both grinding machines and grinding wheels to help you produce more at lower cost. For more information, write Norton Company, Worcester 6, Massachusetts.

To Economize, Modernize with NEW

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GRINDERS and LAPPERS

Making better products . . . to make other products better

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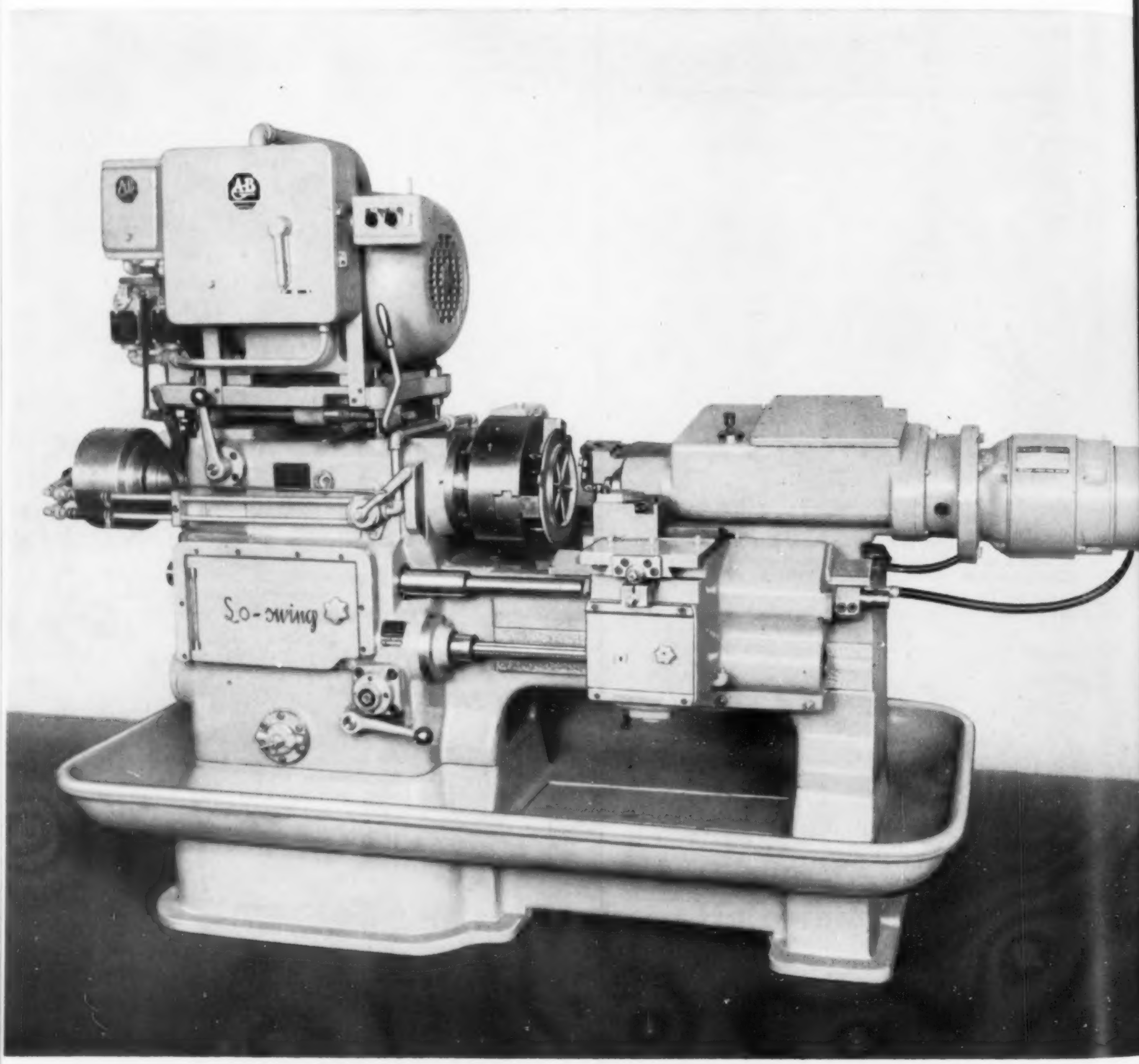
MACHINE OF

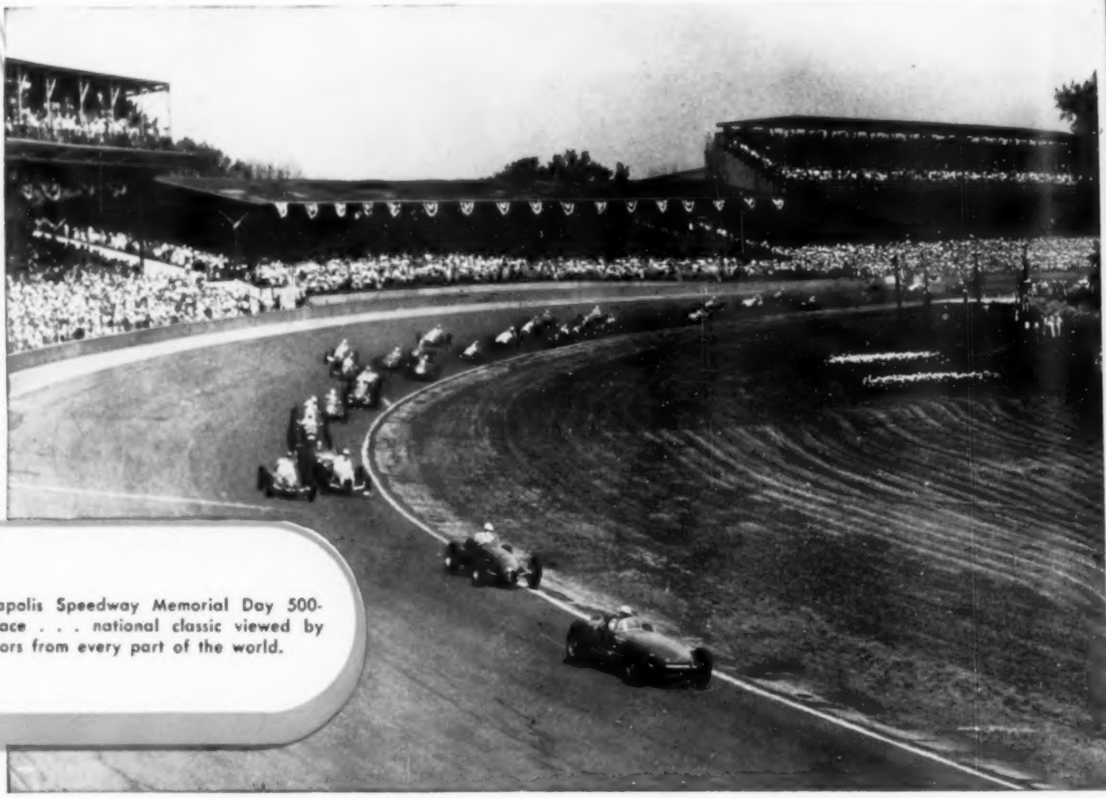
MODEL "LR" So-swing DRILLS AND REAMS SIMULTANEOUSLY WITH TURNING AND FACING OPERATION



PRODUCTION COSTS

LOGAN . . . a national participant in major fluid power advancements

SINCE 1916



Indianapolis Speedway Memorial Day 500-Mile Race . . . national classic viewed by spectators from every part of the world.

LOGAN HYDRAULIC CONTROL VALVES

Illustrated, Model 4015—4-way, 2-position valve for directing pressure alternately to ends of double-acting hydraulic cylinder.

A broad range of types and sizes to most effectively meet any requirement—Design Engineers, Machine Operators, Maintenance Men appreciate these Logan advantages

- LONG-LIFE CONSTRUCTION
- EASY TO SERVICE
- INFREQUENT MAINTENANCE
- EASE OF INSTALLATION
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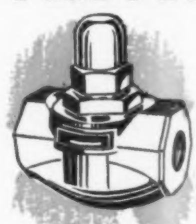
- UNRESTRICTED PORTING

Let Logan Engineers help you design your Air and Hydraulic Circuits



Illustrated, Model 8015 adjustable speed control valve. Install between operating valve and one end of cylinder to meter flow of oil in one direction with free flow on return.

LOGAN MANUFACTURES 6,975 STANDARD CATALOGED ITEMS

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AIR CONTROL VALVES, Cat. 100-4 • AIR CHUCKS, Cat. 70-1 • AIR CYLINDERS, Cat. 100-1 • AIR-DRAULIC CYLINDERS, Cat. 100-3
AIR and HYDRAULIC PRESSES, Cat. 51 • COLLET GRIP TUBE FITTINGS, Cat. 200-5 • HYDRAULIC CONTROL VALVES, Cat. 200-4
HYDRAULIC CYLINDERS, Cats. 200-2; 200-3 • HYDRAULIC POWER UNITS, Cat. 200-1 • SURE-FLOW COOLANT PUMPS, Cat. 62

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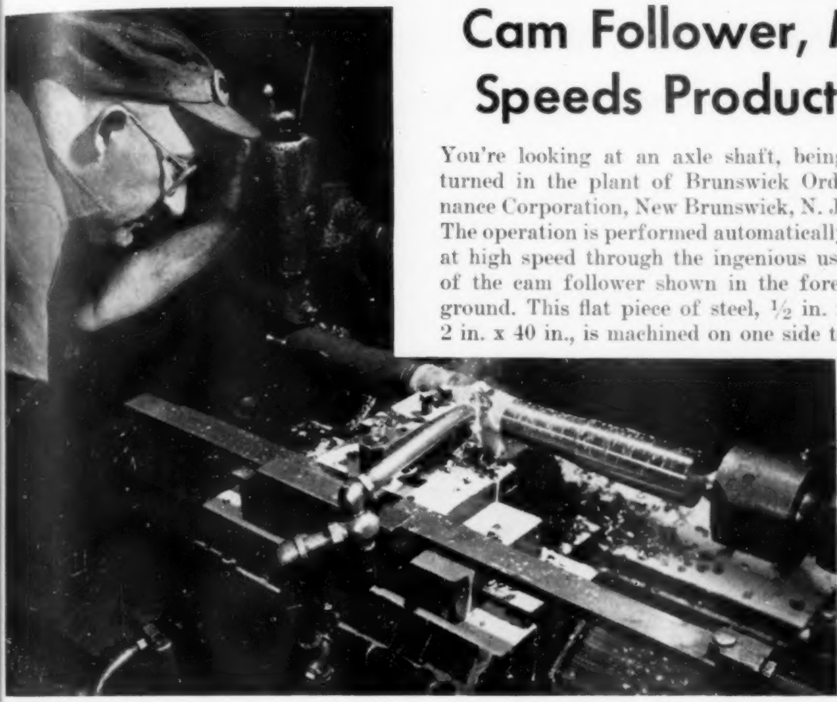
Tool Steel Topics

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation



Cam Follower, Made of Lehigh H, Speeds Production of Axle Shafts

You're looking at an axle shaft, being turned in the plant of Brunswick Ordnance Corporation, New Brunswick, N. J. The operation is performed automatically at high speed through the ingenious use of the cam follower shown in the foreground. This flat piece of steel, ½ in. x 2 in. x 40 in., is machined on one side to the contour of the finished shaft. It moves parallel to the rough bar, making contact with a wheel, beneath the coolant pipe, which in turn actuates the carbide bit.

Engineers at the Brunswick plant needed a steel with good machinability for the cam follower. But above all, they wanted maximum resistance to wear. Which steel did they choose? Lehigh H, our special-purpose high-carbon, high-chromium tool steel.

Lehigh H, an air-hardening steel, is ideal wherever good machinability, maximum wear and minimum distortion are important. It's safe for intricate dies having sharp corners. What's more, it's a deep-hardening steel, with high compressive strength.

Your tool steel distributor has a good stock of Lehigh H. Or you can order a supply direct from our mill depot.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Tool Failures Can Be Caused by Magnetism

Magnetism of either stock or tools can cause mystifying failures of tools. This is particularly true of punch-and-die sets, blanking tools, and occasionally, forming tools. Difficulties traced to magnetism can develop in these ways:

1. Improper feeding or positioning of stock.
2. Improper ejection of parts or scrap.
3. Several multiples feeding in at one time on some operations.

Overloading of tools produced by any of these three conditions can cause tool failure. Besides, magnetized parts pick up steel "debris," which acts as an abrasive on cutting edges, resulting in rapid tool wear. Steel stock can be magnetized by lifting with magnets, or by passing near electrical machinery or power lines carrying heavy currents. Tools are often magnetized by being ground on equipment using magnetic chucks. They can also be magnetized by other accidental means.

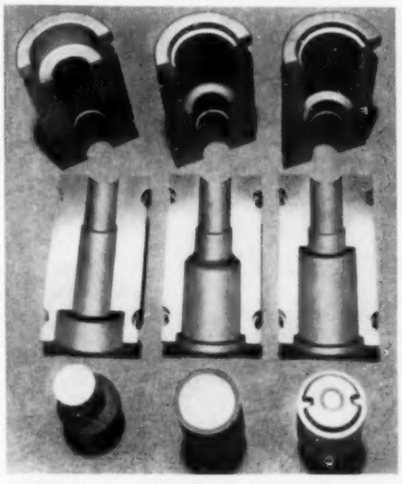
When steel parts or tools show evidence of magnetic attraction to each other, or when the edges attract steel chips or debris, steps should be taken to eliminate the magnetism. With steel stock, this can be done by tempering. But tools must be demagnetized with a demagnetizing coil, by passing them slowly in and out of the coil while it carries alternating current.

BTR HOLLOW-BAR SAVES PRODUCTION TIME

Using hardened bushings? Ring dies? Draw rings? Other ring-type applications? Then you'll find you can save time with BTR (Bethlehem Tool Room) Hollow-Bar.

BTR Hollow-Bar is made from our popular oil-hardening tool steel by a process called high-speed trepanning, in which hammer-forged round bars are cored out in the center, and are then rough turned on the outside. The operation is much like gun drilling, except that in trepanning, the cutter produces a solid bore from the bar center.

With BTR Hollow-Bar, there's no need to wait for forged rings or discs. Nor is there any drilling, rough boring, rough facing or rough turning required. You can get full particulars about BTR Hollow-Bar from your tool steel distributor.



Chrome-Moly-Tungsten Lengthens Die Life

Shown here are sets of forging insert dies and (at bottom), upset punches, used in a hot-work application. The heat-treatment consists of air-quenching and double-tempering to Rockwell C 35-41 for the inserts, and Rockwell C 45-49 for the punches. Said the user, "We like the minimum size change when heat-treating CMW. We get less heat-checking on die impressions, and better resistance to washing effect. And they add up to long die life, which is just what we want."

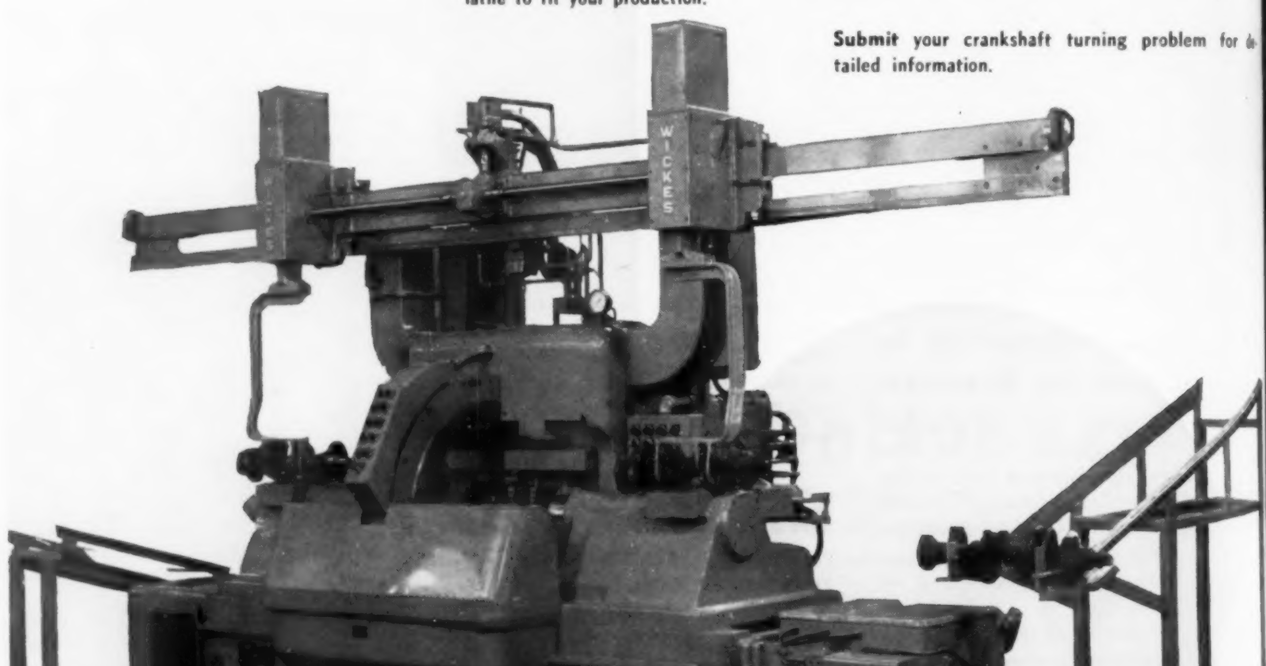
WICKES CENTER DRIVE CRANKSHAFT LATHES

with automatic feeder-unloader now rough and finish machine 20 forged steel V-8 automotive crankshafts an hour on continuous operating cycle

With the new hydraulically operated loader and unloader, Wickes Center Drive Crankshaft Lathes are now machining up to 20 forged steel V-8 crankshafts an hour on a completely automatic work cycle for several of America's largest automobile manufacturers. Here's how the machine operates: Automatic loader picks up milled crankshaft from the loading rack and loads it into center drive position, at the same time it is picking machined crank from the lathe and depositing it on unloading rack. Automatic chuck, synchronized with the loader, closes over the crankshaft as centers move into position. Lathe performs rough and finish cheeking, turning and filleting operations on all main line bearings and finish turns both flange and stub ends. This complete cycle automatically continues to repeat, until transferred to non-repeat by operator.

Wickes manufactures both main line bearing and multiple crank pin turning lathes for all types and sizes of crankshafts. Whether you're machining cast or forged crankshafts or using Tangtung or carbide cutting tools, Wickes has a lathe to fit your production.

Submit your crankshaft turning problem for detailed information.



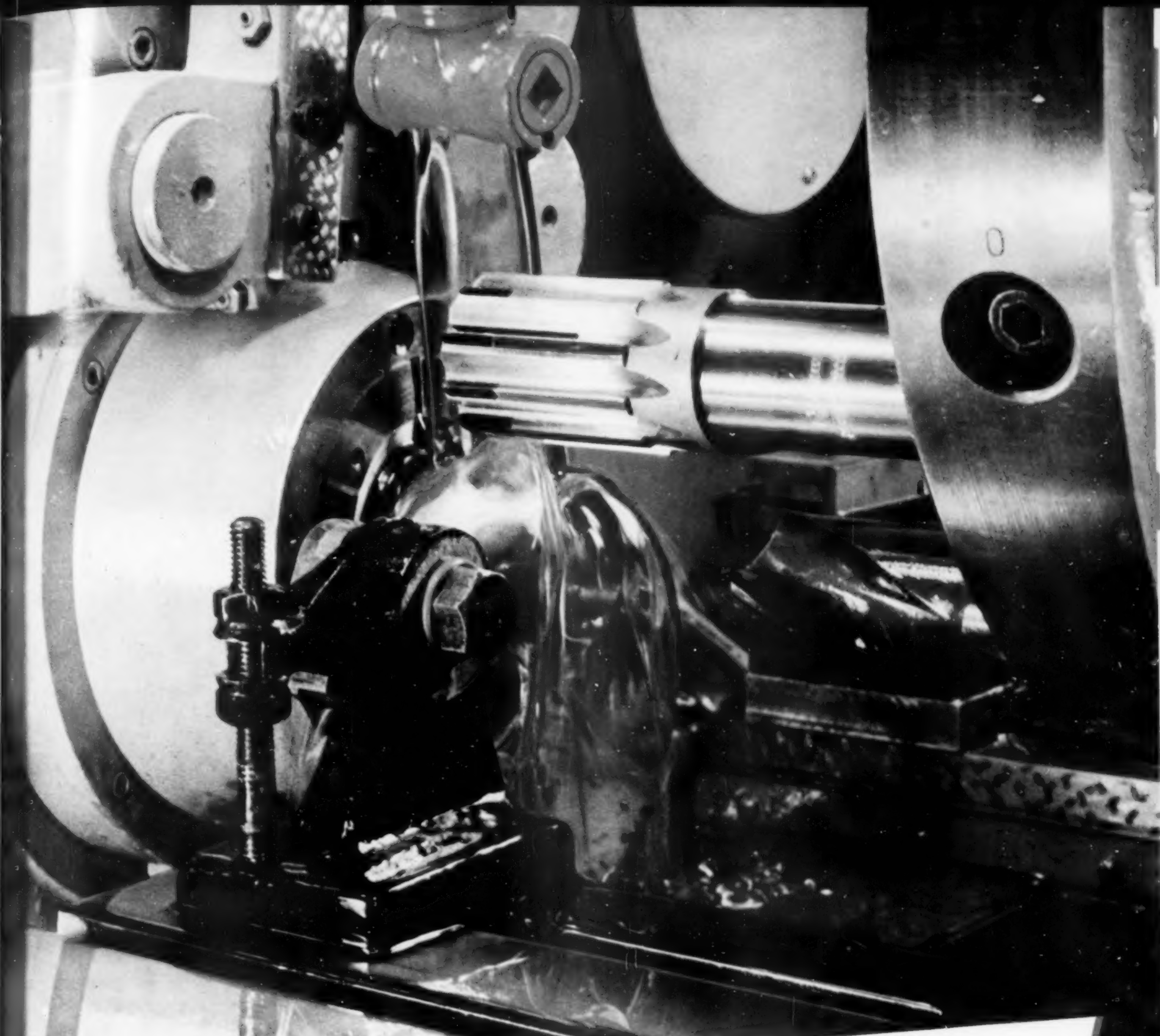
WICKES

100 YEARS' EXPERIENCE IN SOLVING PRODUCTION PROBLEMS

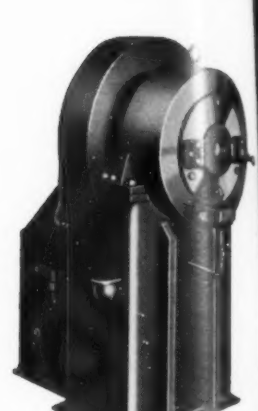
84

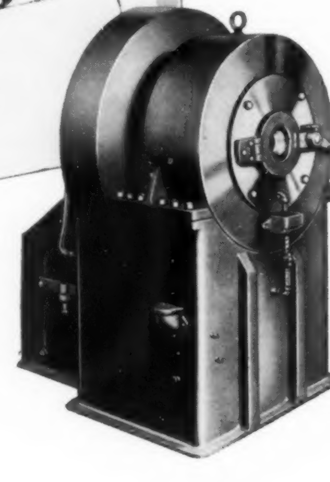
BROTHERS • SAGINAW, MICHIGAN

DIVISION OF THE WICKES CORPORATION



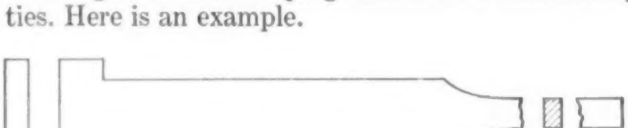
Swaging Success Stories



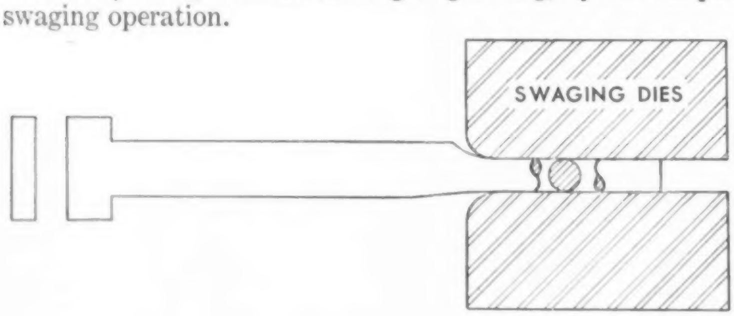


Forming and Finishing Metal Stampings —by Swaging

The application of the swaging process to the forming and finishing of metal stampings has almost unlimited possibilities. Here is an example.



Flat stampings like this one can be given rounded sections, accurately sized, without turning or grinding, by one simple swaging operation.



Can Swaging Improve Your Forming Operations?

1. Swaging is economical—no chips, no wasted material

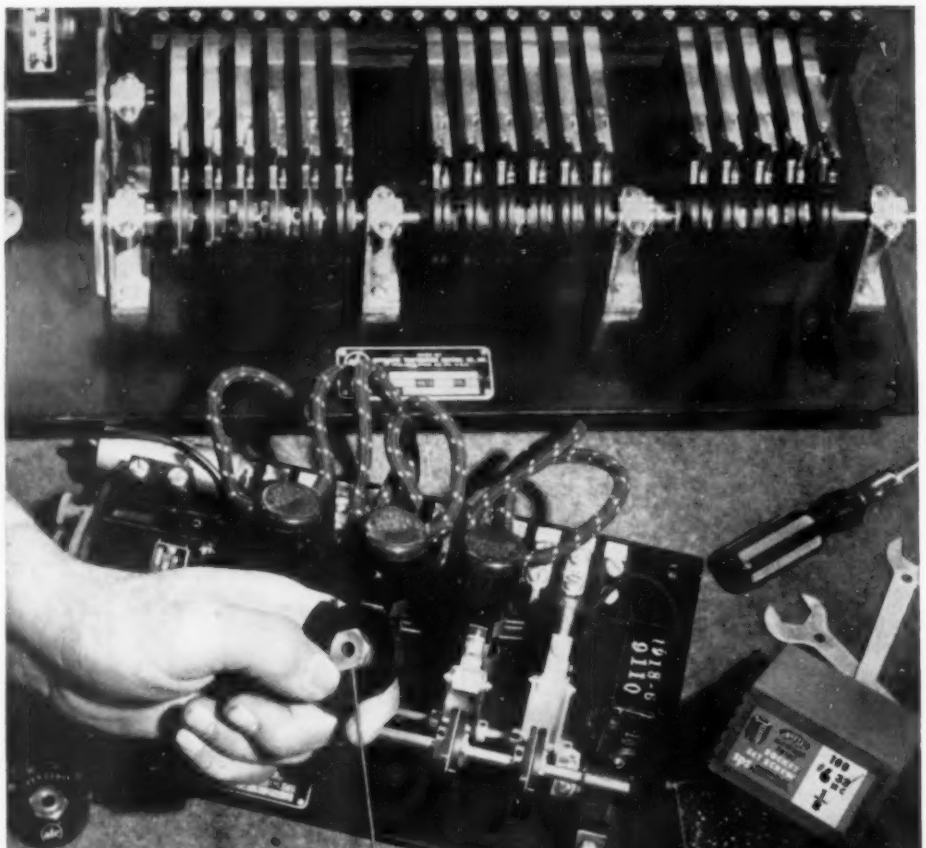
2. Swaging is simple—can be done by unskilled labor

3. Swaging is fast—gives you increased output of special shapes

Our informative booklet on Swaging may give you other ideas for your own "swaging success story." Why not write for it today?

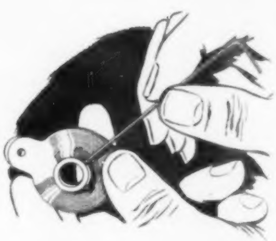
THE TORRINGTON COMPANY
Swager Department
444 North Street, Torrington, Conn.
Makers of Torrington Needle Bearings

TORRINGTON *ROTARY SWAGING* MACHINES



Two UNBRAKO Self-Locking Socket Set Screws are used on each cam of these precision multicircuit cam timers. The screws position the cams so as to control accurately the sequence and duration of one or a series of individually timed machine or process operations.

Assembler picks up tiny UNBRAKO set screw with long arm key preparatory to threading it into cam assembly.



He inserts the UNBRAKO, and turns it into the assembly; then after positioning cam, tightens it. The accurate depth and size of the hex socket result in maximum torquing—the knurled cup point holds the cam accurately in place.

You'll need less space for storage when you use UNBRAKO Standards—stocked by your distributor

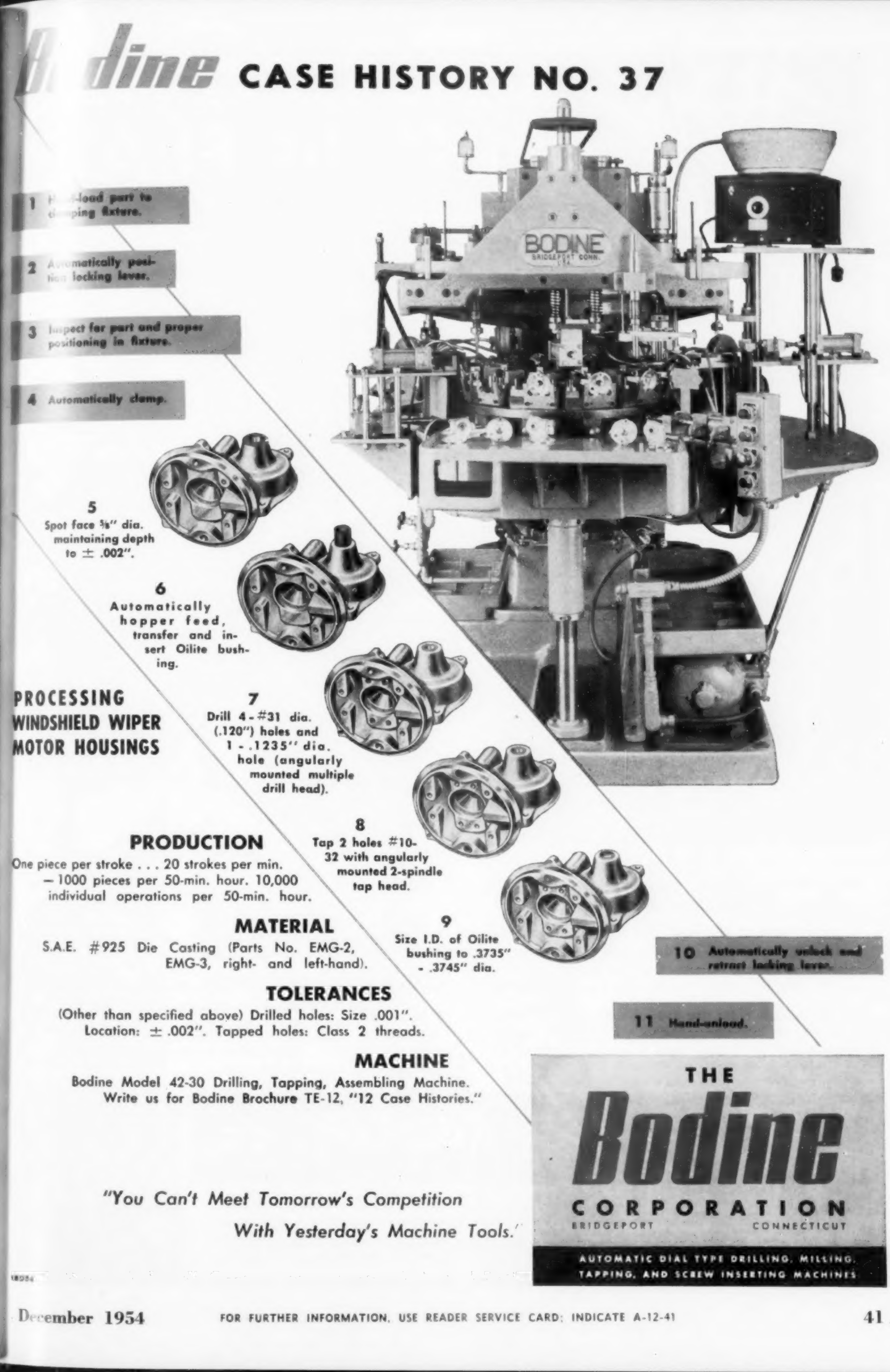
UNBRAKOs—made of heat treated alloy steel—have fully formed threads, Class 3 fit; are supplied in standard sizes from #4 to 1".

You'll need less space for storage and be able to carry a smaller inventory, because standard UNBRAKO socket screw products are in stock at your local industrial distributor's. And you'll save time and money, because deliveries are prompt. For more information, write for UNBRAKO Standards—a complete listing of socket screw products made by the world's largest manufacturer of these precision fasteners. STANDARD PRESSED STEEL CO., Jenkintown 37, Pa.

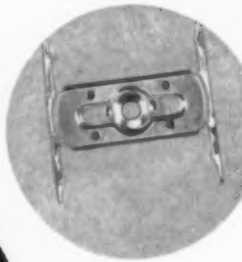
UNBRAKO® SOCKET SCREW DIVISION

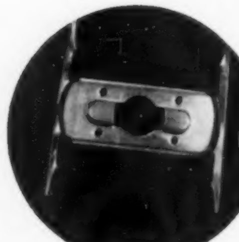
SPS JENKINTOWN PENNSYLVANIA

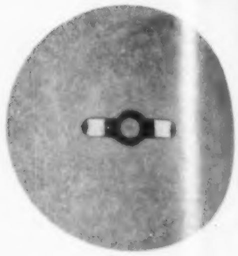
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-40

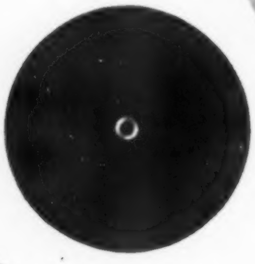

Bodine CASE HISTORY NO. 37
1 Hand-load part to clamping fixture.
2 Automatically position locking lever.
3 Inspect for part and proper positioning in fixture.
4 Automatically clamp.
BODINE BRIDGEPORT CONN. U.S.A.
5 Spot face ⅝" dia. maintaining depth to ± .002".
6 Automatically hopper feed, transfer and insert Oilite bushing.
7 Drill 4 - #31 dia. (.120") holes and 1 - .1235" dia. hole (angularly mounted multiple drill head).
8 Tap 2 holes #10-32 with angularly mounted 2-spindle tap head.
9 Size I.D. of Oilite bushing to .3735" - .3745" dia.
10 Automatically unlock and retract locking lever.
11 Hand-unload.
PROCESSING WINDSHIELD WIPER MOTOR HOUSINGS
PRODUCTION
One piece per stroke . . . 20 strokes per min. — 1000 pieces per 50-min. hour. 10,000 individual operations per 50-min. hour.
MATERIAL
S.A.E. #925 Die Casting (Parts No. EMG-2, EMG-3, right- and left-hand).
TOLERANCES
(Other than specified above) Drilled holes: Size .001". Location: ± .002". Tapped holes: Class 2 threads.
MACHINE
Bodine Model 42-30 Drilling, Tapping, Assembling Machine. Write us for Bodine Brochure TE-12, "12 Case Histories."
"You Can't Meet Tomorrow's Competition With Yesterday's Machine Tools."
THE Bodine CORPORATION
BRIDGEPORT CONNECTICUT
AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

In continuous cycles the V & O #50S Press with dial feed turns out 20,000 complete clamp assemblies for folding wood rules in the regular working day. From right to left—the spring is stripped from a magazine, the female and male clamp halves are formed, an eyelet inserted and expanded, and the complete assembly delivered to a hopper.



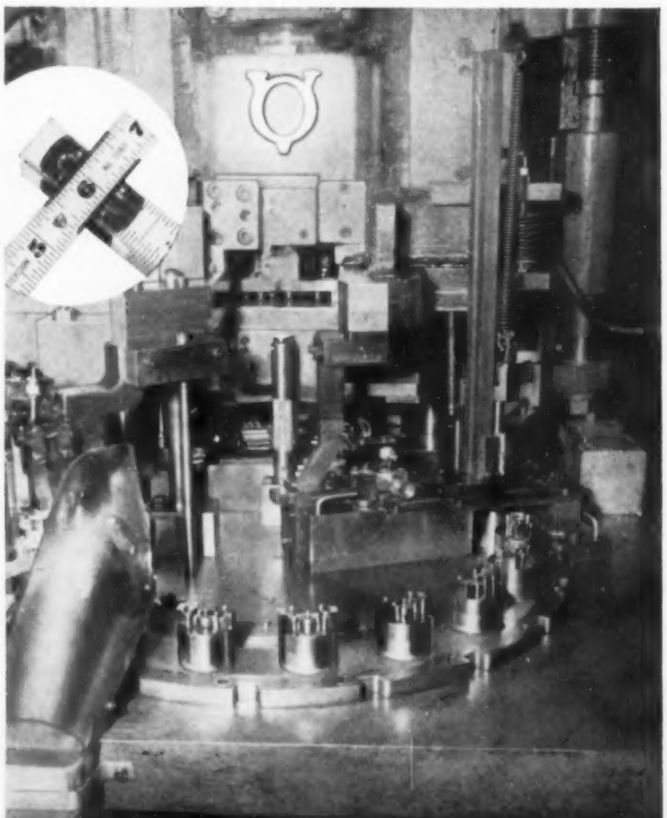






AUTOMATED V&O PRESS

BOOSTS MAN-HOUR PRODUCTION 2000%



The 18 station dial feed on the V & O #50S Press at the Master Rule Mfg. Co. has supplanted 13 smaller presses and more than tripled total daily production. So accurate is the alignment of the press that the dies are removed for sharpening only after each five-millionth piece. Production per man-hour is up over 2000 per cent.

Fourteen men and fourteen machines, working an overtime schedule, previously produced 6,000 clamps for wood folding rules a day at Master Rule Mfg. Co., Middletown, N. Y. Now, one of the original presses, a V & O No. 0, makes the stainless steel springs. A V & O No. 50S with dial feed and two progressive dies has taken the place of the other thirteen machines for producing the clamp halves and completing assembly. Present production, with two machines and two operators, is in excess of 20,000 clamps for a 7½ hour day.

V & O has been designing and building precision power presses since 1889. Because they are built like precision machine tools you can safely use the clever and expensive tooling required for automation. With automated V & O presses you can depend on higher precision production and you can count on lowered unit costs.

Our representatives will be glad to show you how V & O automation can make your operations more productive and more profitable.

THE V&O PRESS COMPANY

DIVISION OF EMHART MFG. CO.

HUDSON, NEW YORK

BUILDERS OF PRECISION POWER PRESSES AND FEEDS SINCE 1889

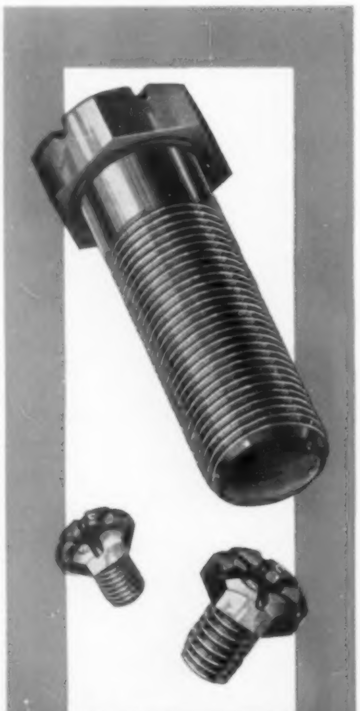
65th Anniversary

Only the best is good enough

 FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-45

Which is the *CleCap*?

. . . both are—all types and sizes of the vibration-proof Place Bolt



Place Bolts are used in all types of automotive and farm equipment, for example—in fly wheels, main bearings, connecting rods and other high vibration points.

Be sure you don't overlook the definite advantages of this *one-piece self-locking* fastener where you have a vibration problem—the *tough strength* developed by cold-forging, and the *economy of assembly* (elimination of locking devices and no limit to the number of times the Place Bolt may be re-used). Saves weight, saves space, saves time.

Licensed under U. S. Patent No. 2543705, CLEVELAND has facilities for mass production of sizes ranging from ¼″ to 1¼″ diameter, standard or special shanks, in carbon (C-5) or alloy (C-8) steel.

Write for guide chart for calculating wrench torques for "Place" type bolts.

The Cleveland Cap Screw Co.

2944 EAST 79TH STREET • CLEVELAND 4, OHIO

VU lcan 3-3700 TWX CV42

CLEVELAND *Top Quality* FASTENERS

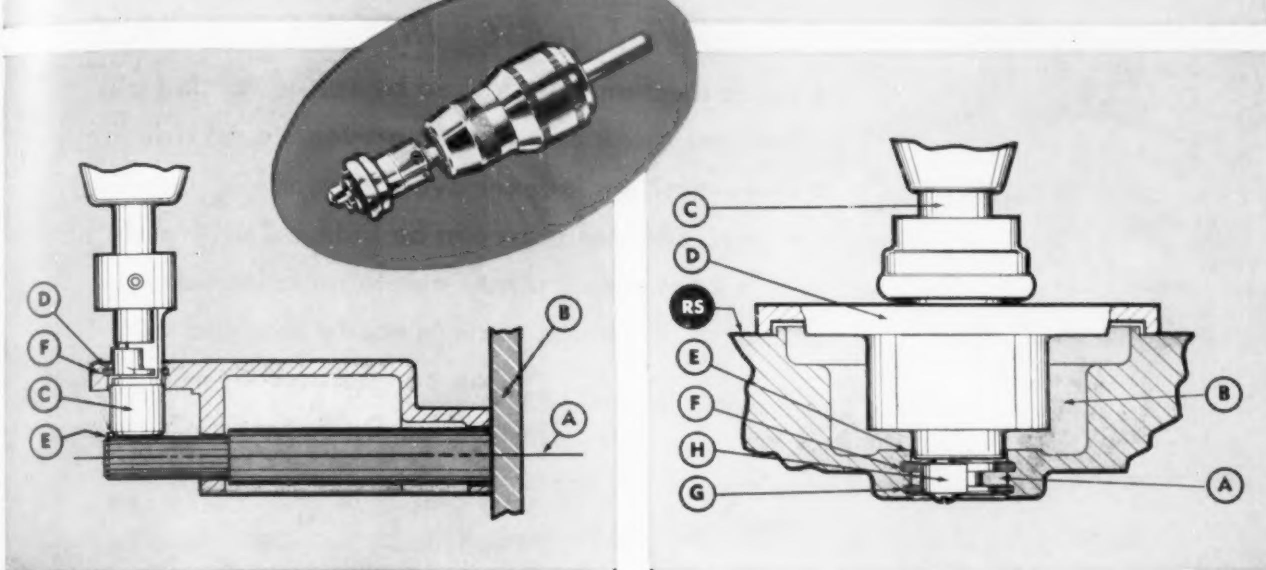
Ferrous and Non-Ferrous: Bright, High Carbon and Alloy Steel Heat Treated, Brass, Silicon Bronze, Stainless Steel

- **Hex Head Cap Screws** — ¼″ to 2½″ dia.
- **Socket Head Cap and Set Screws** — Plain and Knurled: ¼″ to 1½″ dia. Also Flat and Button Head Styles
- **Flat Head Cap Screws**—¼″ to 1″ dia.
- **Fillister Head**—¼″ to 1¼″ dia.
- **Set Screws—Square Head**—¼″ to 1½″ dia.
- **Milled Studs**—¼″ to 1¼″ dia.
- **Place Bolts**—¼″ to 1¼″ dia.
- **Structural Bolts to ASTM Specification A325**
- **Tractor Bolts**
- **Special Hot and Cold Headed Parts**

Facilities to make larger diameters than listed

Originators of the Kaufman DOUBLE EXTRUSION Process

Waldes Truarc grooving tool solves tough internal grooving problems, cuts costs in assembly-line production



Problem: Locating a Groove From Centerline of a Hole A.

(a) Workpiece is fitted into plug on fixture plate **B**.

(b) Bottom adaptor **C** on standard Waldes Truarc Grooving Tool is piloted into bore **D** and registers on side of plug **E**. Groove **F** is cut in exact location required.

Problem: Cutting Two Grooves—One Rectangular, One Beveled—Located In Bore *A* In Large Cavity *B* of Workpiece, and Located From Reference Surface *RS*.

(a) Waldes Truarc Grooving Tool is fitted with elongated spindle assembly **C** and special bushing **D** which spans large cavity permitting tool to register on reference surface **RS**. Bushing also pilots tool into counter-bore at **E**.

(b) Both grooves **F** and **G** are cut simultaneously with special form cutter **H** having both required contours.

AMAZINGLY VERSATILE! The Waldes Truarc Grooving Tool adapts quickly and simply to your toughest recessing requirements. With it, even *unskilled labor* can perform and maintain high precision, mass production operations.

WIDE CUTTING RANGE! The Waldes Truarc Grooving Tool comes in five models: A-1, A-2, A-3, B and C. This wide variety of models enables you to cut accurate grooves in housings with diameters from .250 to 5.00 inches. Special features, modifications and adaptations allow each model to operate efficiently under many varying conditions.

SEND YOUR PROBLEMS TO WALDES! Whatever your internal grooving problem, send us your blueprints and let Waldes Truarc engineers give you a complete analysis, price quotation and delivery information on the most economical tool set-up for your particular job.

WRITE *NOW* FOR 20-PAGE MANUAL CONTAINING FULL INFORMATION ON WALDES TRUARC GROOVING TOOL

WALDES TRUARC

REG. U. S. PAT. OFF.

GROOVING TOOL

MADE BY THE MANUFACTURERS OF
WALDES TRUARC RETAINING RINGS.
WALDES KOHINOOR, INC., 47-16 Austel Place, L. I. C. 1, N. Y.

WALDES TRUARC GROOVING TOOL MANUFACTURED UNDER U. S. PAT. 2,411,426

Waldes Kohinoor, Inc., 47-16 Austel Place, L. I. C. 1, N. Y.

Please send me your new 20-page technical manual on the Waldes Truarc Grooving Tool.

Name..........

Title..........

Company..........

Business Address..........

City.......... Zone..... State..........

TE-126 ★

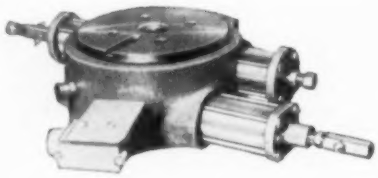
 FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-49

ERICKSON INDEXERS

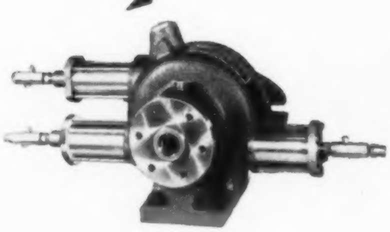
One of these *three* types will answer your AUTOMATIC POSITIONING needs for MILLING, DRILLING, TAPPING, WELDING and many ASSEMBLY OPERATIONS

EXCLUSIVE ERICKSON INDEXER FEATURES:

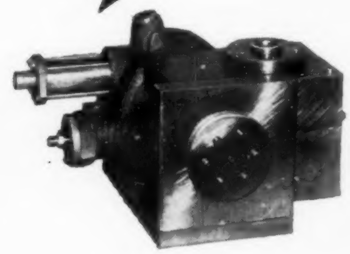
- Index mechanically locked by spring-loaded pin
- Integral shock control unit prevents over-ride
- Three-position indexer available for 120° locating
- Up to 500 positions can be indexed accurately
- Reasonably priced due to ingenious design
- Index plate is easily changed
- Can be operated at any angle
- Operates by air or hydraulics



MODEL 450 ERICKSON SPEED INDEXER is designed for vertical operation. Extra large drive spindle rides on Timken roller bearings at top and bottom of spindle and permits handling of larger and heavier work. This model is suggested for installations where limited height is a factor.



MODELS 400 and 600 ERICKSON SPEED INDEXERS Standard index plate provides 4, 6, 8, 12 and 24 positions. Special indexing parts are available to provide up to 100 positions. Two mounting surfaces provide for vertical or horizontal mounting.



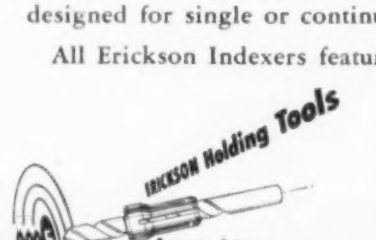
MODEL 477 ERICKSON MULTIPLE POSITION INDEXER accurately indexes up to 500 positions, depending on the gear ratio and index plate employed. Since gear box turns on indexer spindle, unit can be operated in any angle from 0 to 90°. Units are made to customers' requirements.

You can speed up and simplify accurate positioning with Erickson Speed Indexers. For fully automatic operation interlock them in your production line by use of micro switches and solenoid valves. They are designed for single or continuous cycle operation.

All Erickson Indexers feature an adjustable, self-contained shock control unit that assures positive, fast indexing even under heavy load. Maximum speed can be used with no over-ride.

A hardened and ground lock pin operates independently of actuating mechanism to assure positive positioning accuracy within 2 minutes of a degree.

A-9912



Accurate Automatic Positioning Cuts Costs . . .

Write for Erickson Catalog K today! You'll find many interesting applications for all Erickson holding tools. Take advantage of our free engineering service. An Erickson field engineer will gladly work with you for production economy.

ERICKSON TOOL COMPANY

2303-D Hamilton Avenue • Cleveland 14, Ohio

COLLET CHUCKS • FLOATING HOLDERS • TAP CHUCKS • TAP HOLDERS • AIR-OPERATED CHUCKS
EXPANDING MANDRELS • SPECIAL HOLDING FIXTURES

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-50

660 OPERATIONS PER HOUR AT...

80% EFFICIENCY

33 Tractor Pedestals Drilled and Chamfered with BAUSH 3-Way Horizontal Unit!

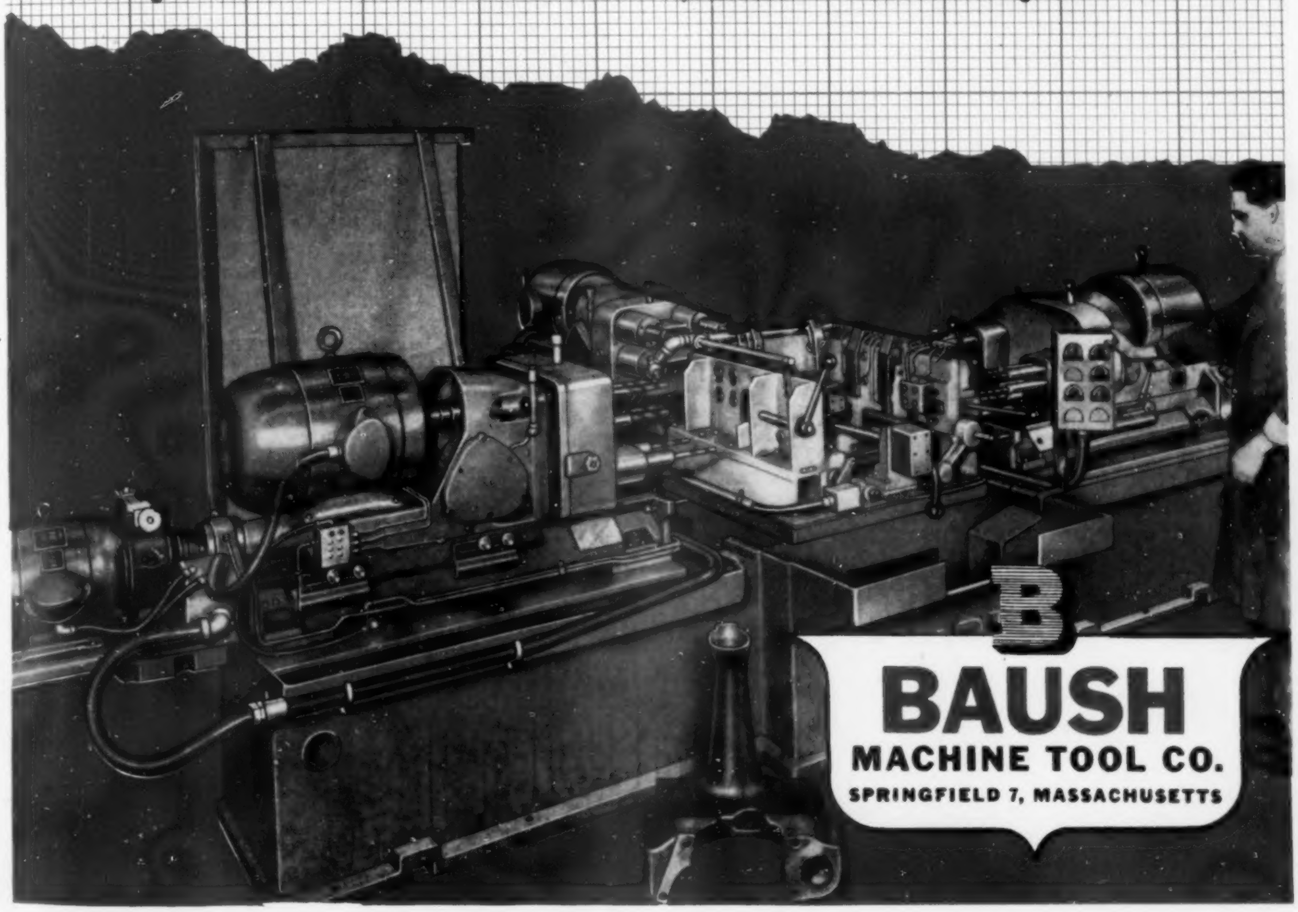
The 3-Way Horizontal Unit illustrated — designed and built by Baush to do this specific job, consists of:

3 Mechanical Leadscrew Units
1 — 10 Spindle Fixed-Center Head
1 — 6 Spindle Fixed-Center Head
1 — 4 Spindle Fixed-Center Head

J.I.C. Controls and Automatic Lubrication. Holding Fixture.

Part:	Pedestal for Tractor
Operations:	10 Drilling — 10 Chamfering
Production:	33 Pedestals per hour at 80% efficiency — A total of 660 operations per hour.

Let Baush design and build equipment to meet your specific machining problems for faster, economical, quality production. Send us your problems — there is no obligation.



you can sharpen

4,800

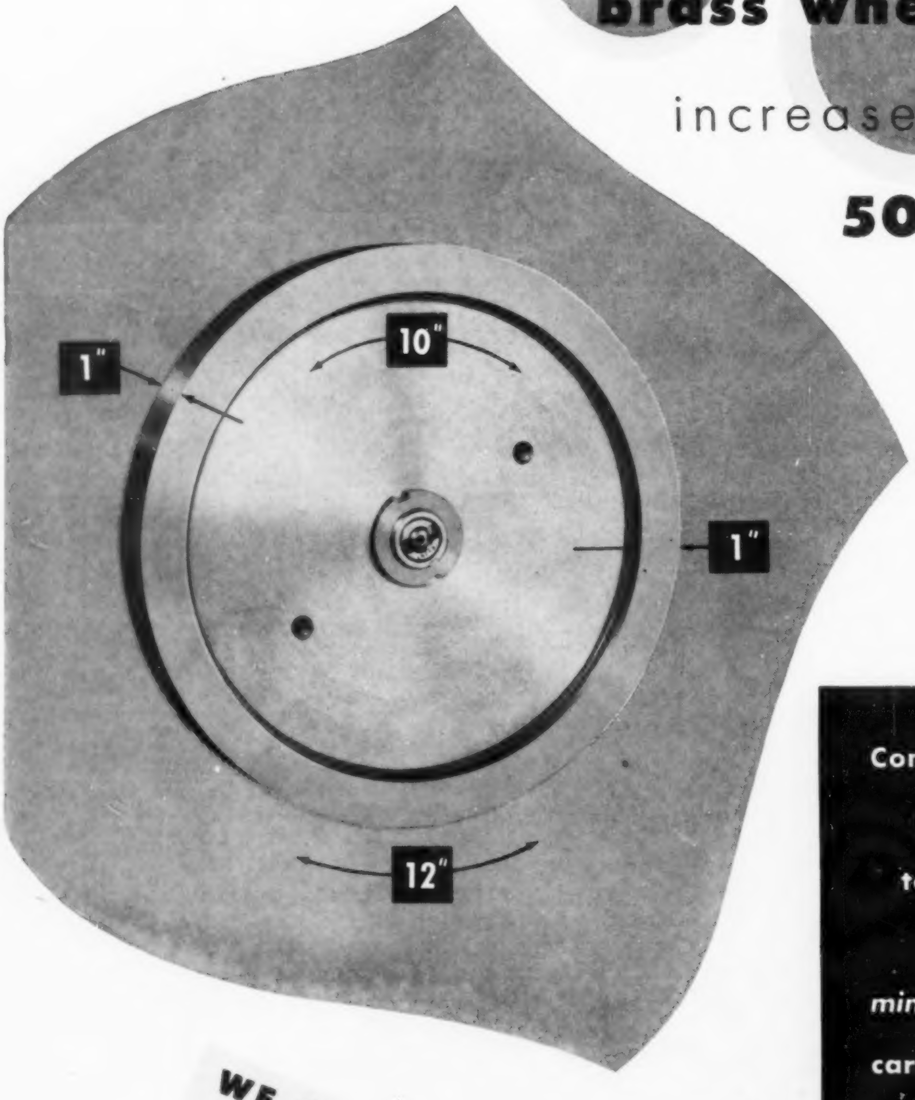
½ x ½ tungsten carbide

insert tools with this $45

brass wheel and

increase tool life

50 to 200%



Ave. cost per tool sharpened:

.009¢

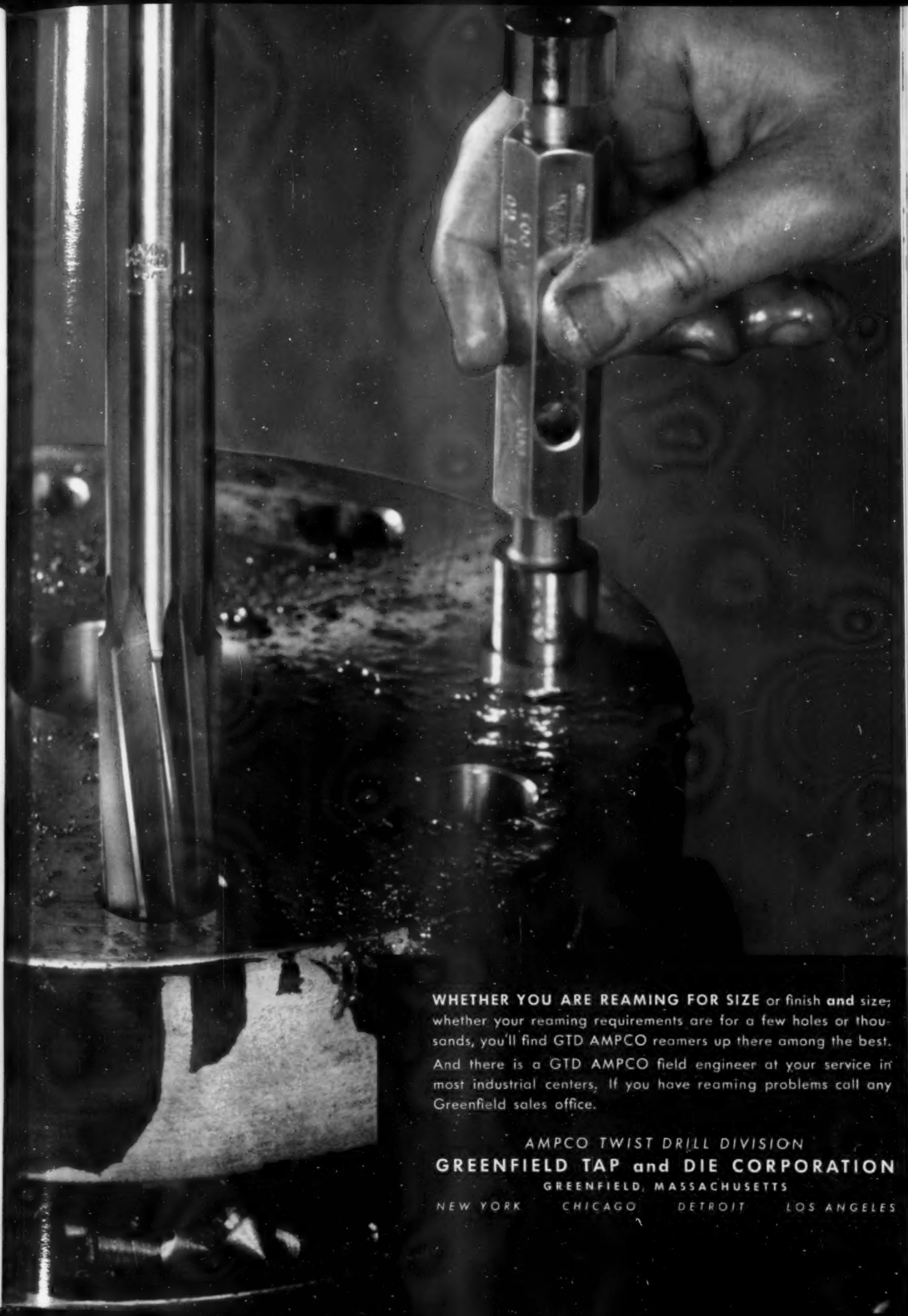
Convert from abrasive and diamond wheels to an Elox brass wheel and save 50 *minutes* sharpening 20 carbide insert tools.

WE CAN SHOW YOU HOW!

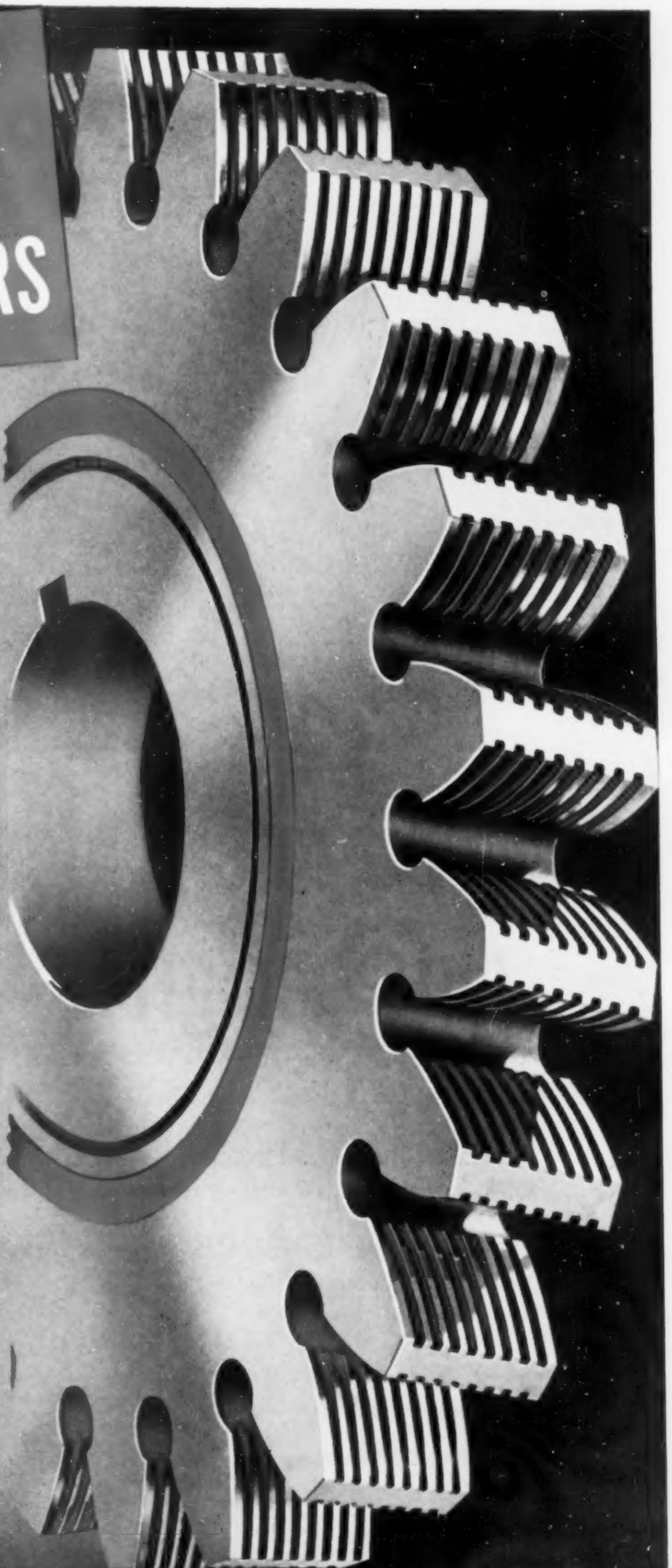
elox *corporation of michigan*

737 north rochester road • clawson, michigan

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-54


WHETHER YOU ARE REAMING FOR SIZE or finish and size; whether your reaming requirements are for a few holes or thousands, you'll find GTD AMPCO reamers up there among the best. And there is a GTD AMPCO field engineer at your service in most industrial centers. If you have reaming problems call any Greenfield sales office.
AMPCO TWIST DRILL DIVISION
GREENFIELD TAP and DIE CORPORATION
GREENFIELD, MASSACHUSETTS
NEW YORK CHICAGO DETROIT LOS ANGELES

CHECK LIST FOR BUYERS OF SHAVING CUTTERS



Knowing the absolute necessity for QUALITY in your gear shaving cutters, you might consider these points the next time you order.

1. How much experience does the cutter manufacturer have?

   Since 1932 when National Broach built the first Rotary Gear Shaving Machine, this company has always been the largest producer of shaving cutters.

2. Has the cutter manufacturer a staff of engineer specialists who concentrate exclusively on cutter design?

   National Broach has such a staff.

3. Does the cutter manufacturer heat treat his own tools and is his grinding department temperature controlled?

   Every Red Ring Cutter is heat treated and controlled by Red Ring metallurgists and ground on special Red Ring grinders under precise temperature control.

4. Does the cutter manufacturer prove every cutter design by actual try-out in his own plant before it is released?

   No new Red Ring cutter design is ever released otherwise.

5. Is the cutter manufacturer prepared to assist you in cutter development — involute modification, etc. when needed?

   National Broach has always maintained such a service for you.

For further information, write for Chapter 2, Modern Methods of Gear Manufacture.

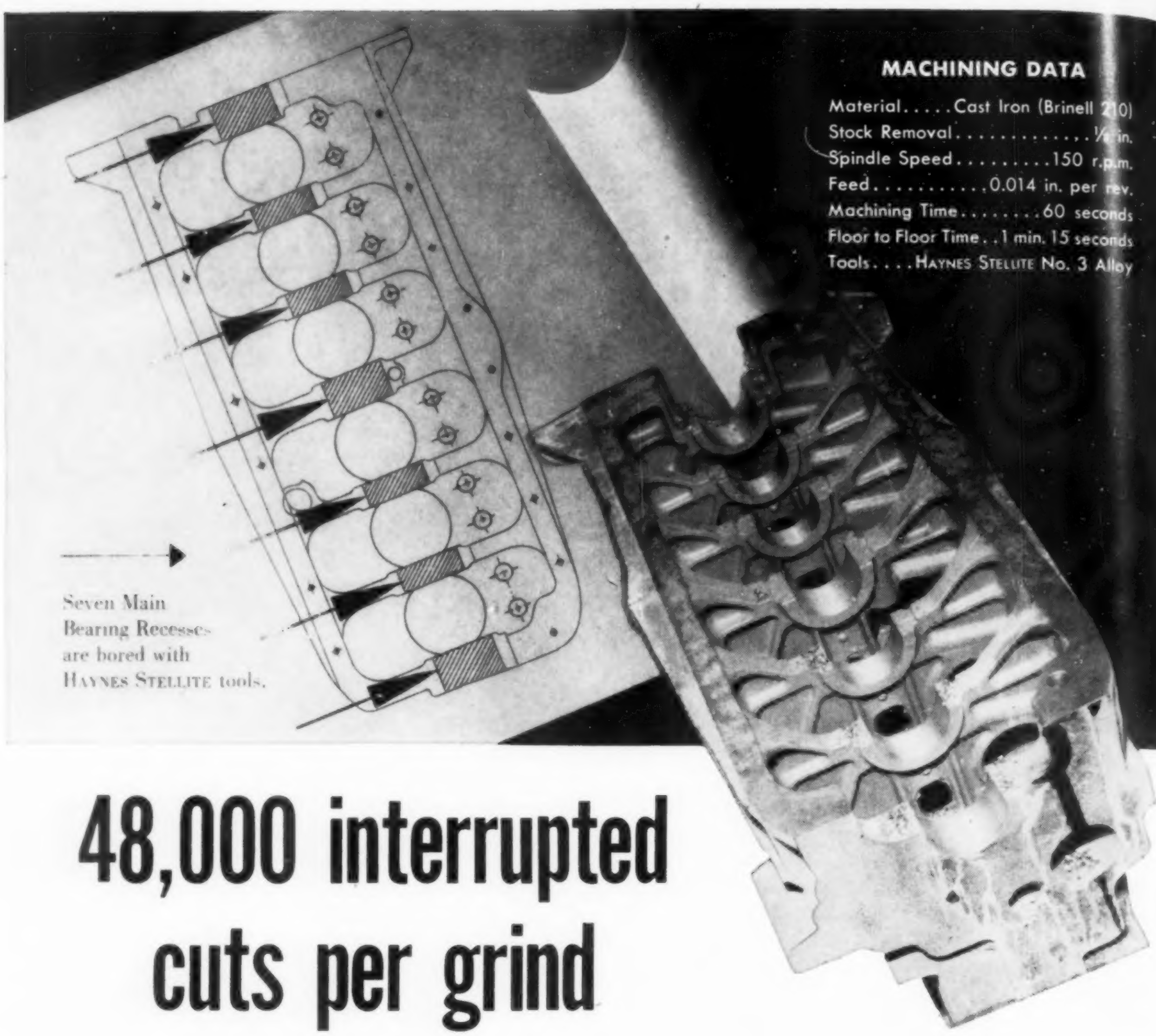
SPUR AND HELICAL
GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING
AND ELLIPTOID TOOTH FORM

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN . . . . DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

7029



48,000 interrupted cuts per grind

HAYNES STELLITE tools machine the main bearing recesses in 320 cast iron engine blocks between grinds. Each of 14 tools used in the set-up makes 150 interrupted cuts in each block . . . a total of 48,000 interrupted cuts per grind. The tools remain in operation for a full eight-hour shift, without chipping or spalling. Other tools tested on this job chipped under the constant hammering of the intermittent cuts, and had to be replaced in less than an hour.

Standard tool bits 3/8 in. square and 2 in. long, made of HAYNES STELLITE alloy No. 3, are used for this operation. Only 0.015 in. of metal has to be removed when the tools are sharpened, and the tools can be reground about 30 times. Then, when they are too short to be used for boring the main bearings, they are used to machine the smaller cam bearing recesses. In this second operation the same tools can be reground about 50 times more!

There are four grades of HAYNES STELLITE metal-cutting tools varying in hardness, compressive strength, and impact resistance. For a complete description of properties, sizes, and recommended operating data, write for the free booklet, "HAYNES STELLITE Metal-Cutting Tools."

HAYNES
TRADE-MARK
ALLOYS

HAYNES STELLITE COMPANY

A Division of Union Carbide and Carbon Corporation

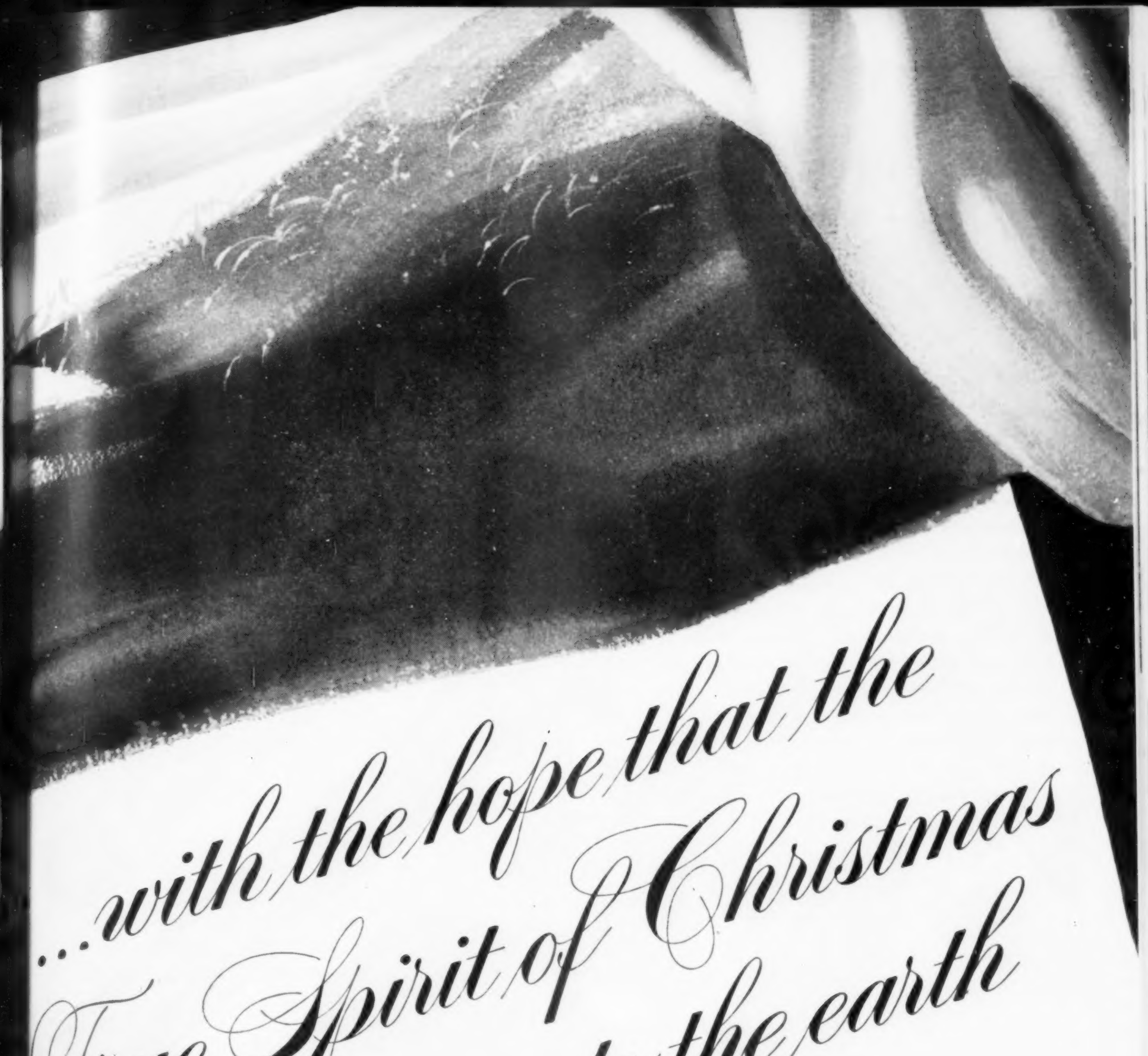
UCC

General Offices and Works, Kokomo, Indiana

Sales Offices

Chicago • Cleveland • Detroit • Houston • Los Angeles • New York • San Francisco • Tulsa

"Haynes" and "Haynes Stellite" are registered trade-marks of Union Carbide and Carbon Corporation


"...with the hope that the
True Spirit of Christmas
may return to the earth
and its peoples..."
NEW BEDFORD, MASS.

No matter what your tool requirements may be — no matter how often tools must be changed—Beaver Quick-Change Tool Holders and Adaptors will save you money.

Beaver's versatile Quick-Change Tooling permits the use of shell mills, face mills, end mills, drills, reamers, boring bars and other desired tools on any Beaver equipped machine without loss of accuracy.

Less than ten seconds per tool change gives you maximum production from each machine. Down-time reduced to an unbelievable minimum.

Beaver Quick-Change Tooling can be installed on most standard machines. Let us show you how it will benefit YOUR machine operations.

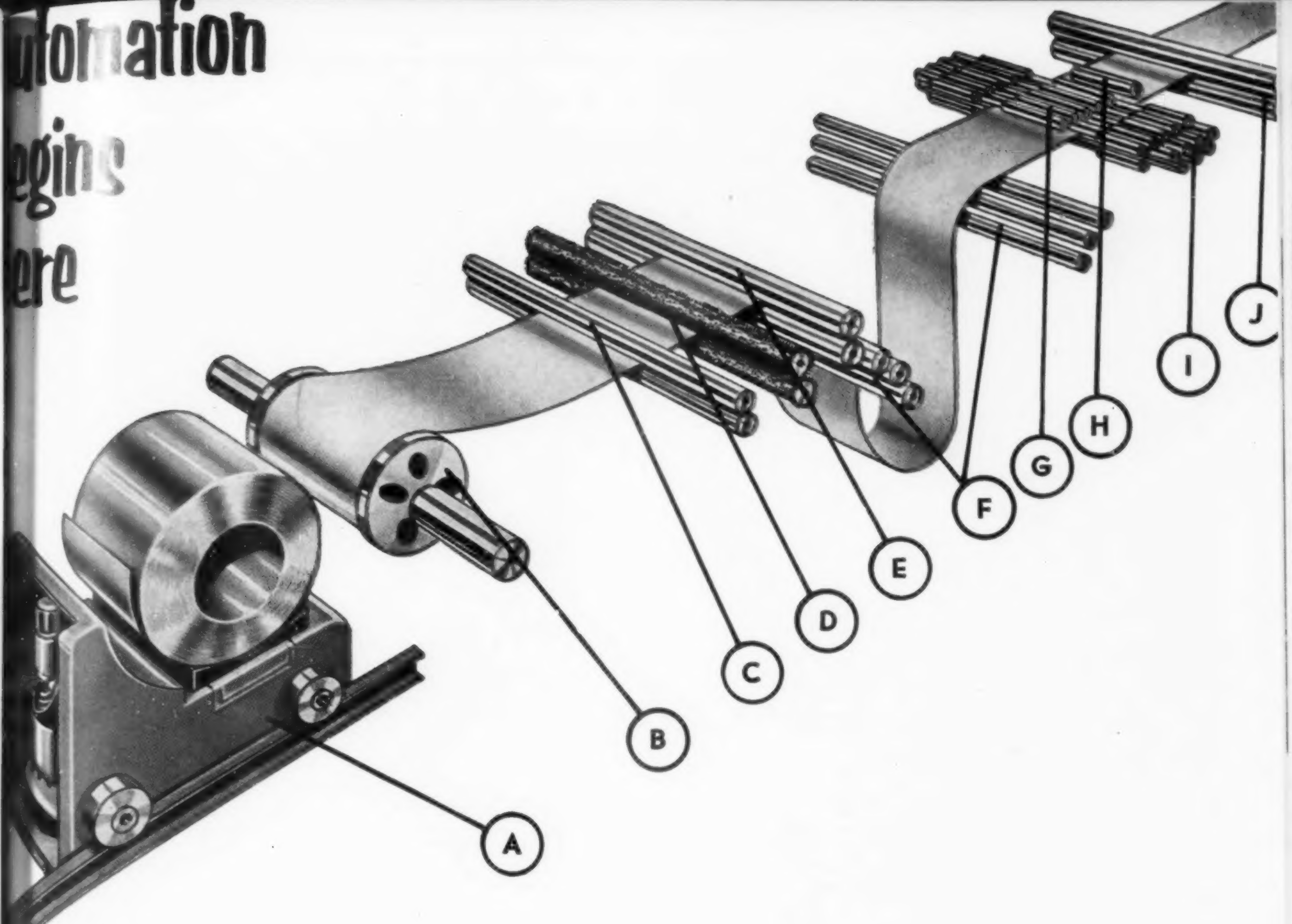
Write for our complete catalog #52.

Beaver TOOL AND ENGINEERING CORPORATION

2850 ROCHESTER ROAD • BOX 429, ROYAL OAK, MICH., Teletype - Big Beaver 648

BEAVER TOOLS ARE WORKIN' TOOLS!

utomation
egins
ere



mation—the automatic handling of work in ess — permits manufacturers to combat high r and material costs by boosting man-hour uction. McKay has played a large part in this ement by designing and building "automated" pment for the automotive and steel fabricat- industries.

example, coil feed lines of the type illustrated e were designed and built by McKay for sev- leading automotive firms. They are used to matically feed coil stock into square shears lanking presses, thus eliminating inefficient laborious methods of manually feeding these hines.

TYPICAL LINE EQUIPMENT

(A) Hydraulic Loading Car for stand-by coil.

(B) Cone Type Coil Holder handles wide range of coil I.D.'s and O.D.'s.

(C) Guide Rolls to direct strip into brush rolls.

(D) Brush Rolls with solvent sprays to clean strip.

(E) Driven Pinch Rolls for pulling coil stock and filling storage loop.

(F) Guide Rolls to support loop.

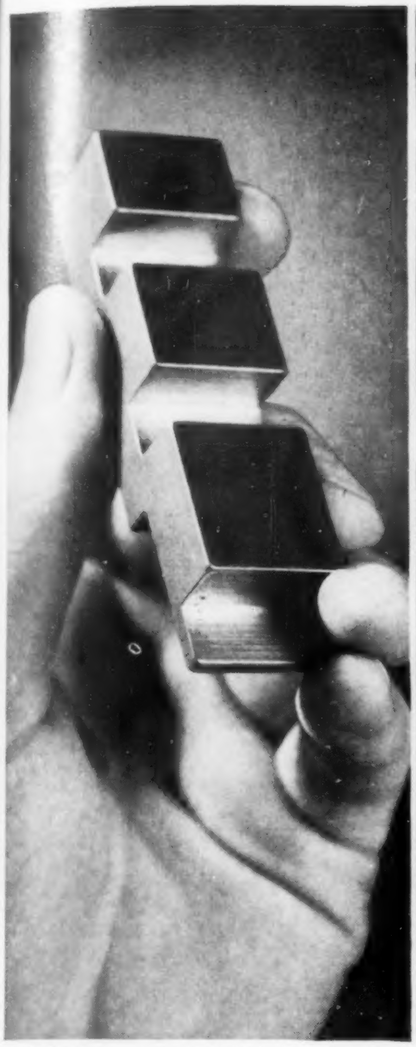
(G, I, J & H) Feeder unit consisting of Backed-Up Leveler **(G-I)** and pinch rolls **(J)** is powered by D.C. drive which is controlled by a measuring device driven from measuring rolls **(H)**. The feeder flattens the strip and accurately measures it into open press dies or through shear knives.

Line operation is synchronized with the press or shear for maximum production. McKay builds these units with design, speed, and capacity dictated by your job requirements.

e McKAY MACHINE Company
YOUNGSTOWN, OHIO

McK

ENGINEERS AND DESIGNERS OF
EQUIPMENT FOR THE AUTOMOTIVE,
FABRICATING AND STEEL INDUSTRIE



This part once cost 21½¢ per piece to finish. The manufacturer investigated barrel finishing and decided to give it a trial.

This method — barrel finishing — proved a sensational cost cutter. The medium is Norton ALUNDUM* Tumbling Abrasive. The cost per finished part today is 5½¢!

This abrasive, a typical Norton finishing development, is sharp, dense, hard and non-fracturing. Its blocky shape eliminates slivers and chips in the process.

Cost on this piece cut 75% with barrel finishing abrasive

"TOUCH of GOLD" *enjoyed as Norton ALUNDUM Tumbling Abrasive goes to work*

This finished part tells the story in a jiffy.

Once the work entailed "hand-deburring" at a cost of 21½¢ per piece. Now barrel finishing with Norton ALUNDUM abrasive does the job and the cost is 5½¢ per piece.

Besides the savings, these other advantages were also gained: ***Uniformity of radii and surface . . . Brighter color . . . Smoother finish.***

Are you taking advantage of Norton ALUNDUM tumbling abrasive in your work?

See your Norton Distributor for further facts. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in the yellow pages of your phone book. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass. G-280

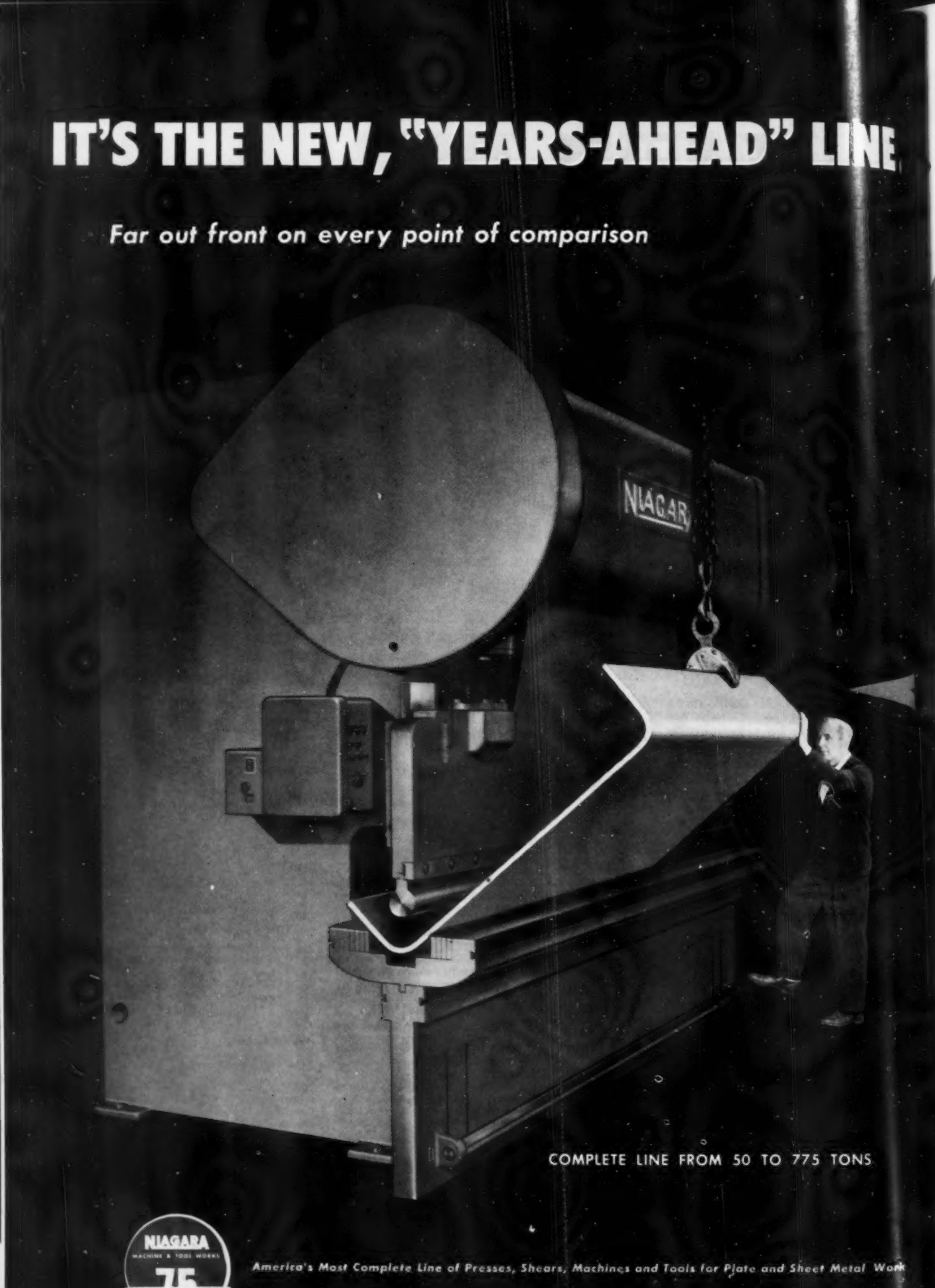
*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

Making better products . . . to make your products better

NORTON

and its BEHR-MANNING division

NORTON: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING: Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes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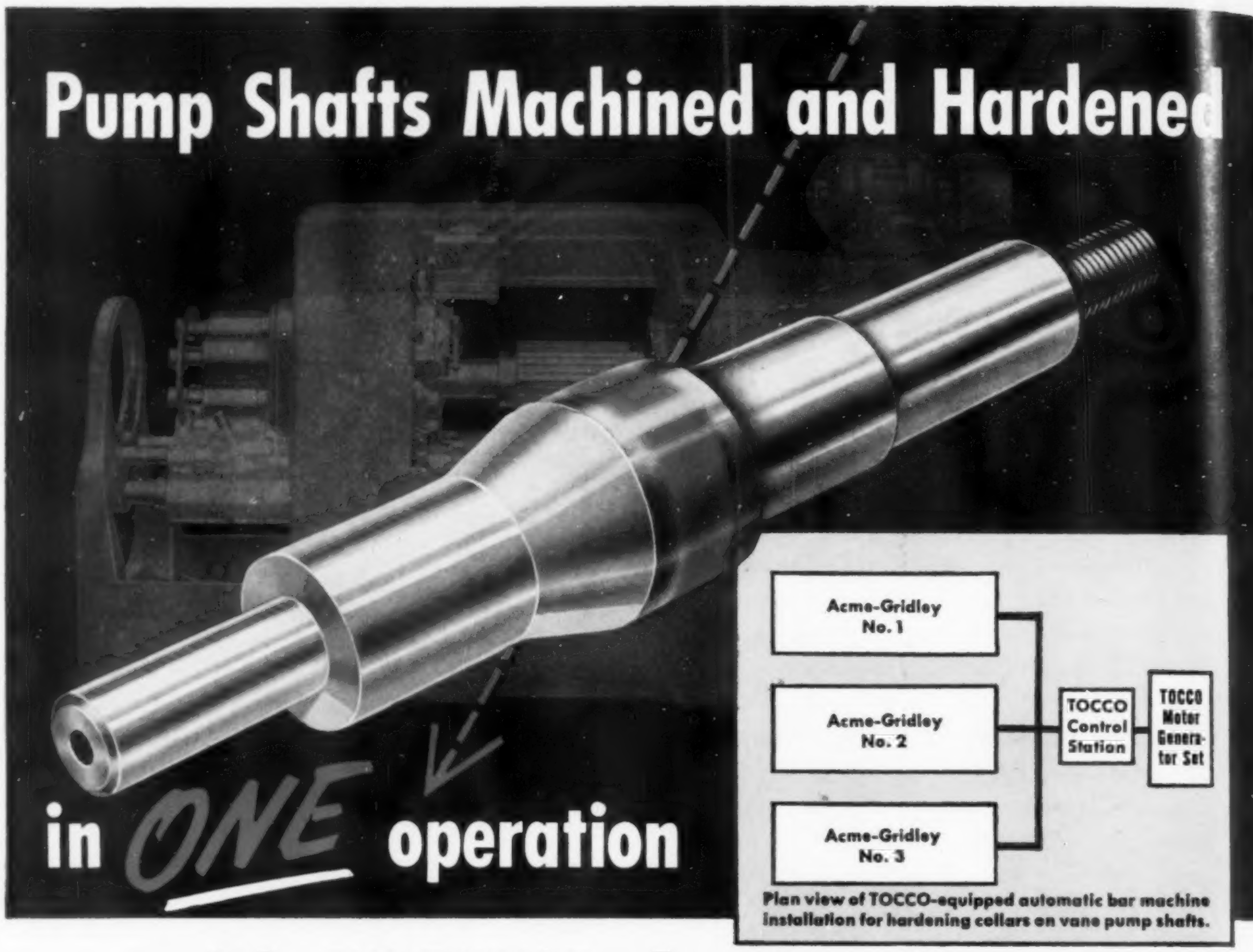

Plan view of TOCCO-equipped automatic bar machine installation for hardening collars on vane pump shafts.

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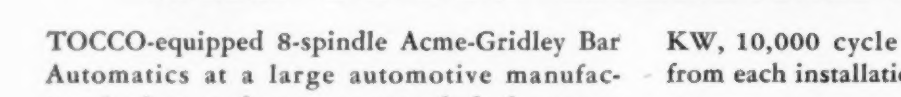

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The Tool Engineer

Award with Honor

I would like to say a few words of commendation about the activities of our National Committee on Honor Awards headed by our able past president, Bert Carpenter.

This committee is expressing the Society's gratitude for the time and efforts spent by our past directors and officers in the formative years of our Society. Not that we all haven't expressed our thanks already to these men, but these pioneers will now have something tangible to remind them of the good work they have done for ASTE.

During the past twenty-two years there have been 223 national directors and officers. Of this number, 206 are still living. It is the intention of our Honor Awards Committee to present an honorary emblem to each at one of his local chapter meetings.

At our Annual Meeting in March it is planned to present for the first time the four following newly established National Honor Awards:

1. ASTE Gold Medal for outstanding service through published literature, technical writings or papers.
2. ASTE Progress Award for accomplishments in the field of manufacturing techniques or production methods.
3. Joseph A. Siegel Memorial Award for contributions through leadership, voluntary support or timely acts of benefit to the Society.
4. ASTE Engineering Citation for unusual skill in the development of tool engineering principles.

These awards not only will give deserved recognition to those who have made distinctive contributions to our profession but also will inspire others to contribute to the extent of their ability for the good of everyone.

Joseph P. Crosby

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plastic tooling comes of age

By Robert F. Parks*

Manufacturing Engineer
Beech Aircraft Corp.
Wichita, Kan.

Acting as a coordinator between manufacturing and tooling, Bob Parks is responsible for a large part of the development work for his company. He received a masters degree in chemistry from the University of Wichita and has been working with plastic tooling since inception of an experimental program into this field at Beechcraft in 1943. The first successful application of plastics tools at Beechcraft was in 1945. In addition to being a Junior member of the ASTE, he holds a membership in the American Chemical Society.

Plastics have gained an important place in industrial tool and diemaking but some false impressions have grown up around these highly useful materials. Before any attempt is made to use plastics in tools, their properties and limitations should be thoroughly understood. Plastics are not cheap. Although they can and do save money, their purchase prices are several times greater than those of metals currently used in conventional tooling. The savings come later—in the event plastics prove feasible for a given tooling application—in the form of reduced man-hours during fabrication of the tool, easier handling, *Fig.* 1, and lower maintenance.

Plastics are not cure-alls. Although plastic dies, jigs and fixtures have been known to outlast metal tools formerly used for the same purpose and although they are better fitted for many jobs, they

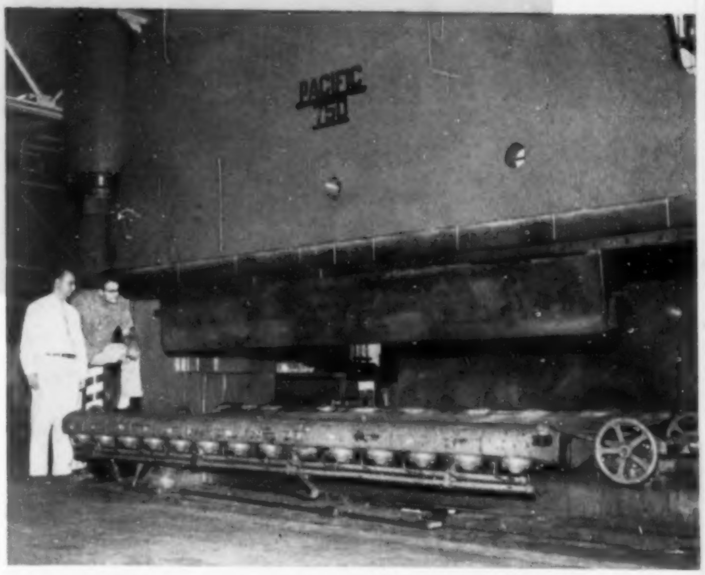


Fig. 1. This skin stretch die used to shape leading edges of aircraft wings is phenolic reinforced with steel. Weight is a definite factor in a tool of this size, especially since the press is used for other purposes and frequent handling of tools is necessary.

should be considered as supplements to conventional methods and materials and not as complete replacements.

Generally speaking, the feasibility of using plastics is questionable unless a man-hour savings of at least 40 percent can be realized in the tooling-up process. At Beechcraft savings as high as 80 percent have been made in this category. This then, should be one of the prime considerations when deciding whether to use plastics. Unfortunately, there is no exact formula that can be used in approaching the problem of whether plastics will or will not prove suitable in a certain shop or for a certain job.

To determine suitability of plastics requires specific knowledge of the problems at hand, as well as general understanding of plastics and tooling. This is especially true in deep-draw work. It is not necessary that one person be a specialist in both fields, however. For example, a plastics expert can learn from a deep-draw specialist just what problems are involved in fabricating a certain die or tool and just what jobs these latter will be required to perform. From this information, he can determine whether plastics will fill the need and what formulation should be used.

Some factors to consider are the severity of the forming operation, the length of the run and the total tonnage requirements for the job. Data sheets and literature distributed by plastics manufacturers

***Junior member ASTE Wichita chapter.**

Fig. 2. A skin stretch die, cast phenolic with a foamed phenolic core, can be lifted in place on the press by two men. Also, this plastic tool can be repaired in place if necessary.

are helpful in determining limitations of current plastics. Technical assistance from manufacturers' representatives is also valuable.

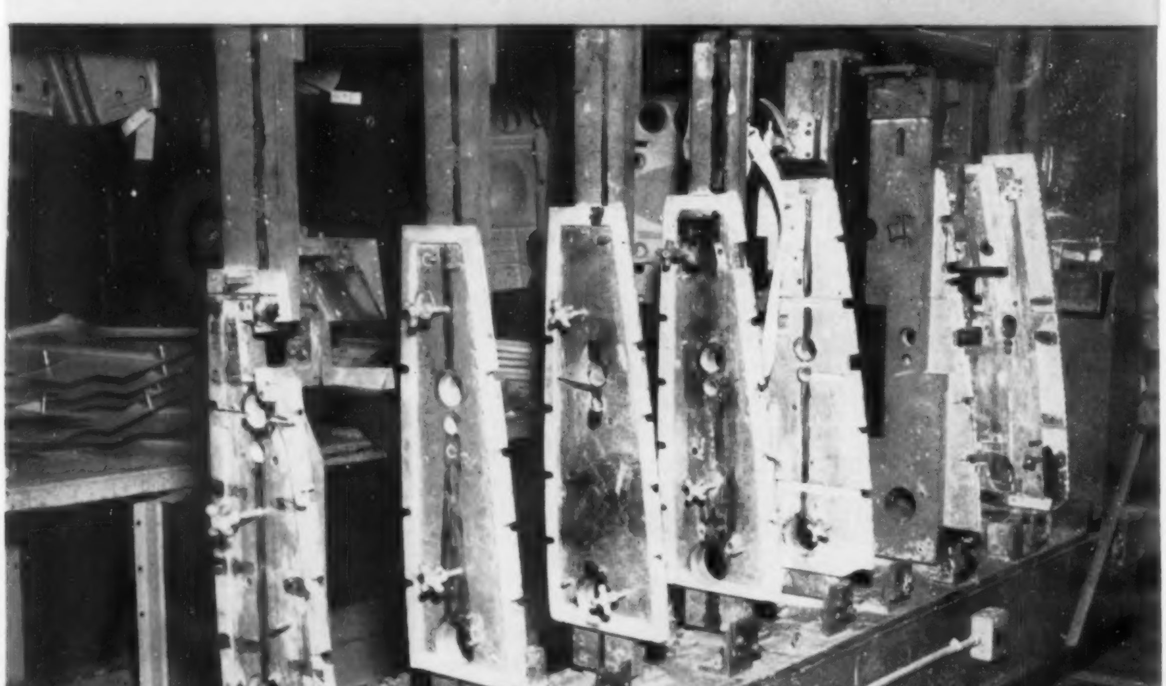
Before covering the uses of specific plastics and their range of operation at Beech Aircraft, some of the advantages that have been established in connection with their use will be discussed. Tools and dies can be formed quickly and put into operation with minimum delay, either as temporary units that can be used until other equipment is ready or as permanent installations. Principal advantages in the use of plastics include: savings in man-hours; accurate reproduction of layouts; elimination, in some cases, of the need for expert tooling personnel and flexibility in application.

To point up the last named benefit, plastics make possible the building of a large drop-hammer die or a tiny drill jig with material from a single stockpile whereas with metal, several stockpiles must be maintained to permit this range of operation.

Light weight is also a factor. Plastics average about 70 lb per cu ft as against some 448 for Kirksite, 487 for steel and 710 for lead. Two men can lift a plastic stretch die, *Fig.* 2, onto a press bed, while the same die made of other materials would require the use of hoists or lifts to set into place.

Light weight is a help when dies must be moved, but another characteristic of plastics is even more important if the die becomes nicked. A plastic tool can be repaired in position in about 30 minutes, but a nicked metal tool has to be removed for welding and hand grinding—a job that usually requires from 3 to 4 hours.

Fig. 3. Wing panel drill fixtures are made by casting epoxy around the outer edges of steel plates to match a pattern. The plastic hardens and becomes a perfect contour without machining.



Plastics currently being used at Beechcraft are phenolic casting resins, polyester resins and epoxy resins, laminated with glass cloth or cast. All of these are used alone, in conjunction with each other or with materials other than plastics. Additional plastics are in the experimental stage and development work is being done with polyester resins for use as back-up material for epoxy faced drop-hammer dies.

Although less expensive, polyester has given way to epoxy in many applications because the latter can be cast solid without the need of a shrink pattern and can generally be applied to a wider range of uses. As an example, epoxy is now being used to do all the things polyester formerly did and, in addition, is used for master gages and check fixtures, both of which are made with low-pressure laminating procedures using room-temperature cure and no pressure during cure. Polyester is not considered stable enough for such applications.

Other low-pressure epoxy laminates include drill router, scribe and trim fixtures. With casting techniques, epoxy is being used to cast drill bushings in locating surface contours on master tools and abrasion blocks on trim fixtures. In some cases, it replaces low-melting casting alloys in jig-pad fittings. Rigidity of polyester resins is considerably variable and there are shrinkage problems during catalyzation. Epoxy, on the other hand, is almost rigid and there is no shrinkage connected with its use, *Fig. 3*. These differing characteristics make the plastics ideal for working together to fill special requirements. While the two materials are best fitted for different jobs, some assignments can be handled equally well by both, with the final decision as to which to use being based on such things as cost, personal preference or convenience.

Phenolic casting resins practically run the gamut in their usefulness and, like the other plastics, have an apparently unlimited life when used within, or close to, the limitations listed on the manufacturer's data sheets. There are few stretch and extrusion dies that cannot be successfully fabricated with phenolic casting resins. The range of this versatile plastic also embraces draw dies, post-forming tools, low-pressure laminating tools, check fixtures and back-up blocks for drill fixtures. Phenolic is equally effective when used in large and small tools.

All skin stretch dies at Beechcraft, for example, are made with a wood fiber board or aluminum base and a foam phenolic core faced with two to three inches of cast phenolic. This diemaking technique has proved inexpensive both in installation and through lowered maintenance costs. In use since 1947, these skin stretch dies have never broken down and appear to have unlimited life.

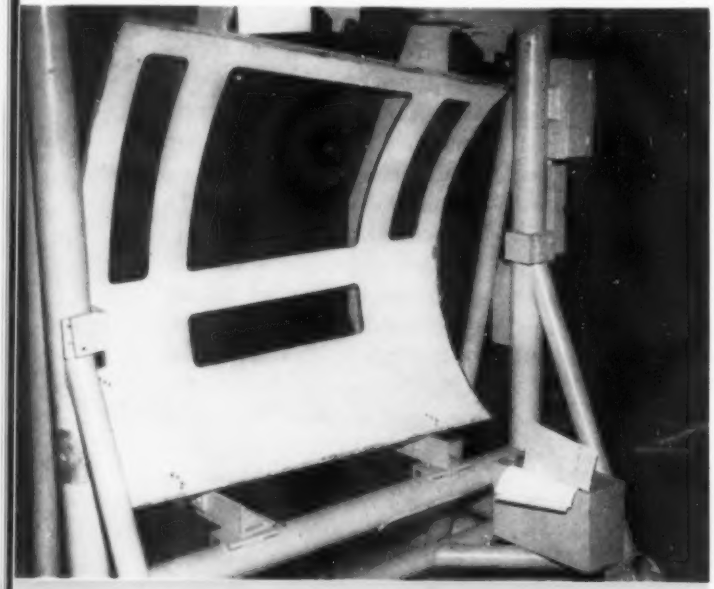
Other plastic tools in use the same length of time, and which also appear capable of lasting indefinitely, have had thousands of parts routed over them, including all window enclosures and other parts for the nearly 4000 Bonanzas that have been built since 1947, as well as for several other models of planes. Metal router guides on these

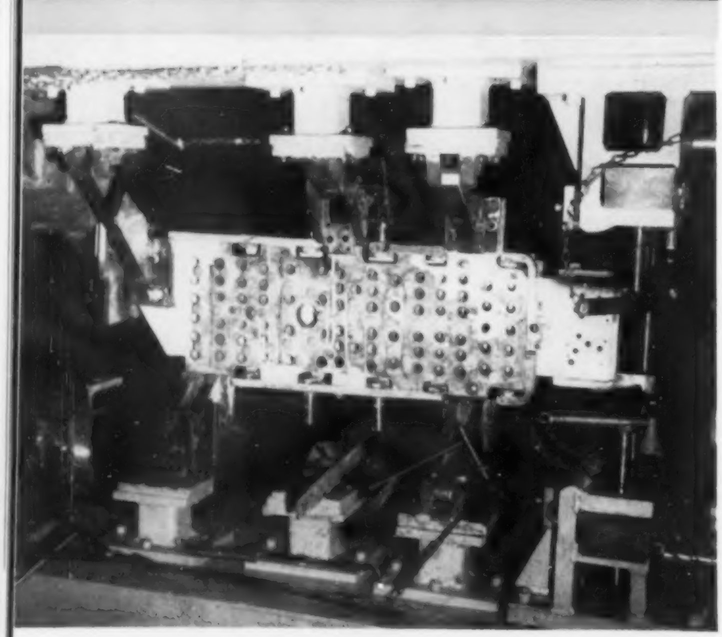
Fig. 4. Metal router guides used on tools such as this leading edge assembly fixture have to be replaced frequently but the plastic parts continue to serve. Cost of machining a metal fixture to match the rib corrugations would be prohibitive.

plastic tools, *Fig.* 4, have been replaced often.

The advantages of using phenolic resins in constructing draw dies are not difficult to determine. If using Kirksite, for instance, the metal would have to be cast to a shrink pattern, with male and female mating surfaces cast separately and then ground to a blue block, a time and money consuming process.

No finish work is required on the mating surfaces to make the same die with phenolic resins. The plastic is cast from a standard pattern, without worry of shrinkage. In this process, one of the mating surfaces is cast, covered with a layer of wax measured to equal the thickness of the material to be worked and then filled with phenolic resin. The second casting operation produces a perfectly mated die, without need for grinding.





Plastic tools are being used in the production of both plastic and metal parts. Six post-forming tools are turning out phenolic and thermoplastic parts at Beechcraft. Such tools can be foam cored or cast solid. High temperature epoxy or polyester resins work equally well in such applications. Suede rubber coverings are still used when forming clear plastics, such as airplane canopies.

Plastics really come into their own when used to fabricate such tools as trim fixtures, *Fig.* 5. The compound curvature of such fixtures presents serious problems and makes exact and satisfactory duplication all but impossible when conventional strap steel is the basic material. The use of plastic changes this from a difficult operation to a relatively simple one. This technique is also used in making backups for drilling operations, supplanting the use of an overpress. In this case, a polyester resin and glass fiber combination is especially suitable.

Epoxy has proved especially valuable in the building of Keller drill jigs for airplane wing panels, *Fig.* 6. One such tool has 375 holes that have to conform to a Class 2 fit, an especially troublesome assignment until epoxy was brought into use to cast bushings into place. First, oversize holes were drilled and matched against the master hole pattern while the jig was held in exact position by locating pins. Then the bushings were cast into place with epoxy and a perfect fit resulted.

Plastics have definite advantages over metal for certain uses and a decision to use plastics should not be based solely on the twin factors of time and cost savings. Wherever conventional metals can serve as well as plastics, however, it is well to keep in mind the difference in cost of the materials.

The average price of metals currently used in tooling is about 25c a pound, while plastics cost from 40c to $4 a pound. These prices are based on commercial plastics now on the market. Beechcraft does not formulate its own plastics but does carry on experimental work for its own information and to assist plastics companies in meeting the firm's needs and requirements. Because of this work and a long plastic tooling background, the company has steadily increased the usable and successful range of plastics. There is reason to believe that these materials might eventually replace the conventional metals entirely.

Fig. 5. (top) Trim fixtures, with compound curvature, represent places where plastics are unquestionably superior to metals. This fixture for exterior aircraft skins is laminated of epoxy and glass cloth.

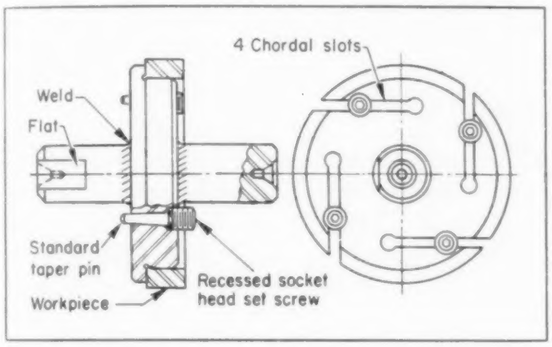
Fig. 6. (bottom) Time and money savings are represented by this laminated epoxy and glass fiber Keller drill jig. Savings in time are measured in months and cost is cut by two-thirds through substitution of plastic for metal.

Gadgets — Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work

Precision Mandrel for Large Rings

Precision between-center turning or cylindrical grinding of the OD's of large diameter rings can be efficiently done with the illustrated mandrel.

The mandrel is made as a weldment for economy. A round blank of proper size is bored and fitted to a central shaft and the two welded together. After stress relieving, the weldment is center drilled and finished to the proper diameter for a snug fit onto



the lower limiting dimension for the ID of the workpiece. It might be desirable to cylindrical grind this OD for highest precision work.

Layout is then made for the chordal slots. Before slotting, the hole is drilled for the end of each slot. The holes for the taper pins and setscrews are also drilled, taper reamed and tapped. These should be near the outer end of the slot for greatest effectiveness.

When the setscrews are tightened against the standard taper pins in the tapered holes, the slotted segments will expand outward and tightly grip the workpiece without distortion. Releasing the workpiece is simply a matter of backing off the setscrews and tapping the small end of each taper pin. For this reason the taper pins should be case hardened.

On some jobs standard taper pipe plugs can be used to replace the taper pins and setscrews by drilling and tapping a standard pipe thread. The taper pipe plug expands the segments satisfactorily. However, the taper pin method is recommended when wider rings are to be made, for more uniform expansion over the width of the mandrel.

H. J. Gerber
Member at large

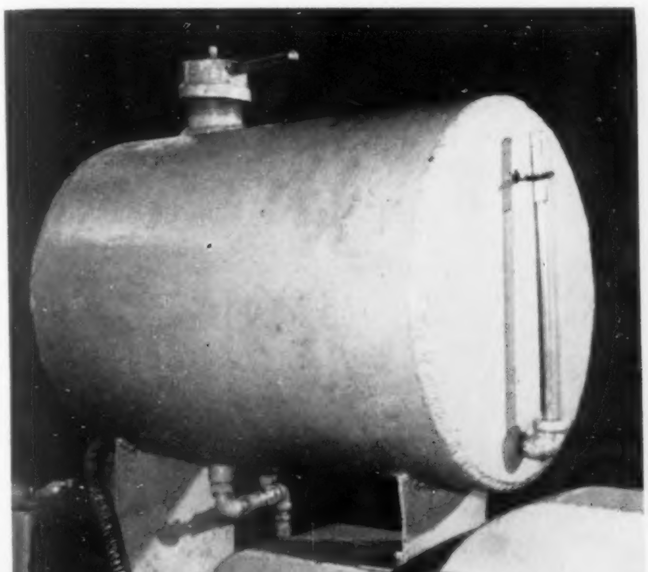
Oil Level Gage

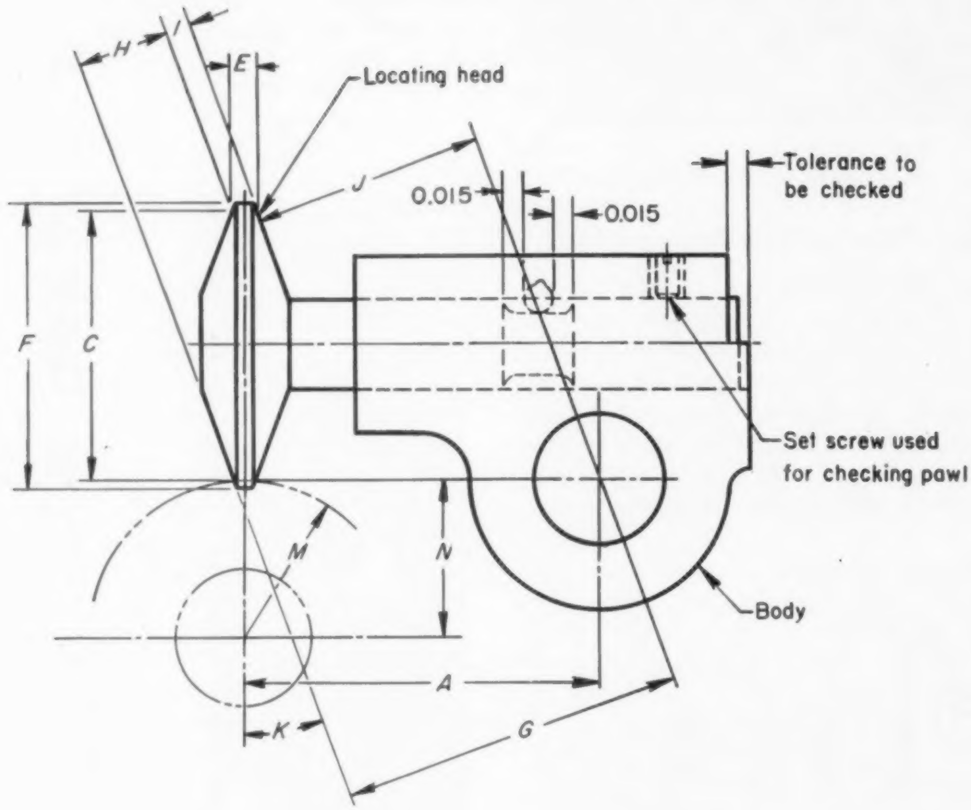
Refilling cutting oil tanks on radial arm routers and drills and overhead pin routers formerly was a tedious job for the maintenance department at Temco Aircraft Corp. The only means of checking the level of liquid in the tank was to remove the tank filler cap and squint inside with the aid of a flashlight. Of course, this required that the machine be stopped so the oiler could climb on the machine table.

Each machine's five-gallon tank normally is drained in a full day's operation. To keep up with all machines, which operate irregularly, the oiler made five to 10 tank-checking circuits a day.

The inexpensive oil level sight gage shown in the photo has simplified the job, reduced machine down time and eliminated a safety hazard. The gage consists of an upright plexiglass tube connected to the bottom of the tank by a right-angle elbow. Checking oil levels can be done instantly from the aisle. It is estimated that the installation paid for itself in man-hours saved within two days.

G. W. Patridge
Dallas, Texas





Gage for Checking Gear Location

A locating pawl is commonly used to accurately locate two or more gears or other related parts to gear teeth. The next problem is to gage the results. The checker shown is so constructed as to accurately gage the relation of a gear tooth space to any other tooth space, locating hole or finished surface and is comparatively simple to make.

The body and locating head are made separately, then fitted together as shown. All bearing surfaces, where location or alignment is important, must be lapped. The step representing the tolerance to be gaged may be ground in the body. The locating head is then assembled and clamped by a setscrew. The step is then finish ground to the proper dimension.

The completed gear checker can be used as a feeler type gage or a master surface can be ground on the body. An indicator gage can be used with the checker where limits are too close to use as a feeler type—any step of less than 0.005 or $\pm$ 0.0025 inch should be checked with an indicator gage. When the tool engineer sets up his design, dimensions A and C can be any practical values desired as long as centerlines of gear and gear checker are at 90 degrees. The other dimensions are:

$E = \frac{1}{2}$ (thickness of tooth on pitch line)

$F = C +$ (one addendum on dia)

$G = A + E \cos K$

$H = C \sin K$

$I = 2E \cos K$

$J = G - (H + I)$

$K =$ pressure angle $+$ ($90° \div$ no. of teeth)

$L = 2K$

$M =$ pitch radius (from part print)

$N = \sqrt{M^2 - E^2}$

Dimension N is a line running through point of contact and not tangent with pitch radius. This device has been found to be highly satisfactory from many years' use in the shop.

A. C. Good
Dayton Chapter

how INSERTS *improve nylon gears*

By Louis D. Martin

Gear Consultant
Rochester, N. Y.

NYLON, an exceptionally good gear material, has the unusual property that has been called compliability and a desirable low frictional coefficient. Nyon, grade FM-10001, has a flexure that is approximately seventy-five times greater than steel. Because of this ability to flex under load, it is not as sensitive as metal gears to the most destructive gear tooth errors like pitch and profile errors.

In order to become insensitive to pitch and profile errors, nylon gears must be stressed sufficiently to cause yielding and compliance. When this point is reached, each gear tooth will adapt itself momentarily to its mate during the instant of tooth engagement. Nylon gears work well with other nylon gears but perform better with more rigid metal gears, particularly hardened steel which has less flexure and thus causes greater compliability of the nylon.

This condition can be likened to rubber tires on an automobile which yield to, or comply with, the irregularities of the road. The requirement for compliance is that sufficient pressure be applied to cause the tires to yield.

Gears that operate under light loads and which are not flexed enough to take advantage of the inherent characteristics of the material do not operate any better and are not noticeably quieter than metal gears under the same operating conditions. Tooth inaccuracies are just as disturbing. Nylon has no miraculous sound-absorbing property; in fact, it is not as good in this respect as some of the laminates. When properly applied, however, good results and impressive savings can be realized.

In view of the impetus given to nylon gearing by the perfection of injection molding techniques, *Fig.* 1, it is appropriate and timely to discuss some of the limitations of nylon, as well as advantages.

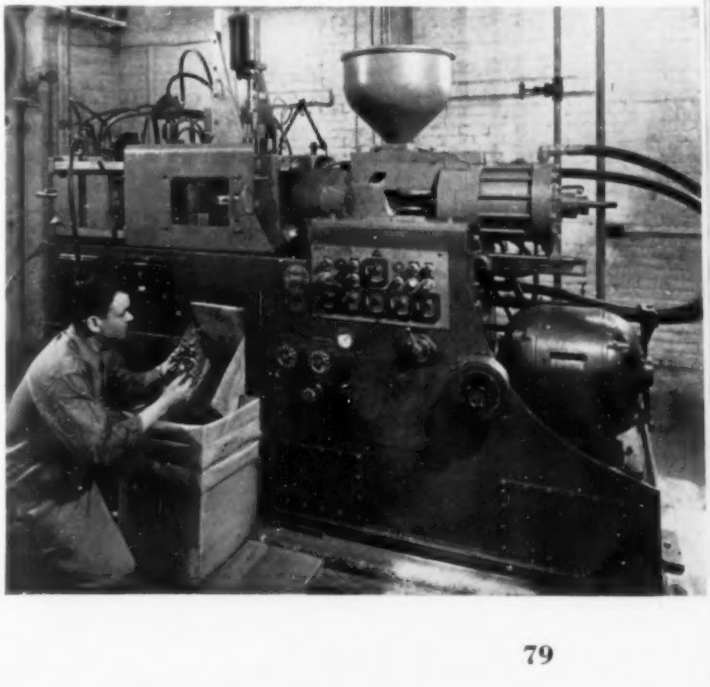
Properties of Nylon

In a number of recent applications where nylon gears were substituted for steel gears, failures were reported. Investigations disclosed that the load on the teeth could be transmitted safely by steel gears but not by the weaker nylon. It was apparent that when the substitution was made, the lower beam strength of nylon was not taken into account.

Nylon gears of a given pitch, pressure angle and face width cannot be expected to replace steel gears of the same design. Yet, many engineers and buyers, not having sufficient information on the limitations of the material, insist on substituting nylon for highly stressed metal gears.

The safe working stress of nylon is approximately 4500 psi at 70 F. It is higher at lower temperatures and loses its tensile strength rapidly at elevated temperatures. At 170 F, for instance, the safe working stress drops to approximately 3400 psi, a loss of nearly 25 percent. For maximum life, nylon gears should not be used at sustained temperatures of 200 F.

Fig. 1. Setting up for a production run of injection-molded parts on a 3-oz. Fellows machine.



The redeeming feature of nylon is that, because of compliability, the tooth load is more evenly distributed over the several teeth in engagement. That's one of the reasons why they last longer than metal gears when operating within the range of safe working stress for the material.

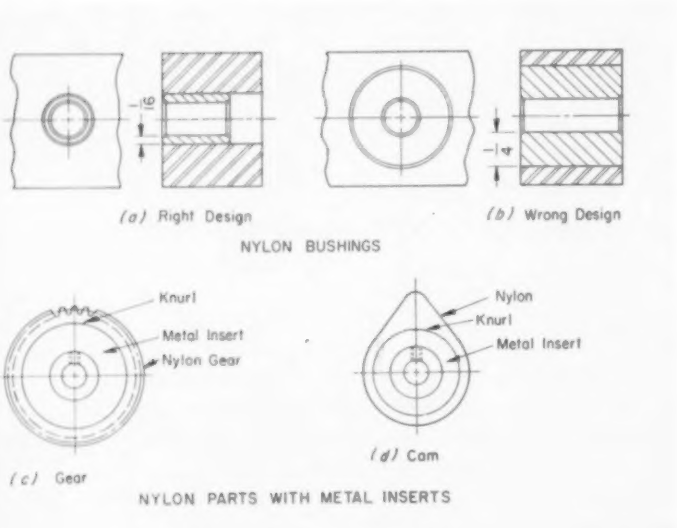


Fig. 2. Nylon bushings have better stability when walls are thin. Gears and cams have more dimensional stability when molded with metal inserts. Also, capacity may be greater.

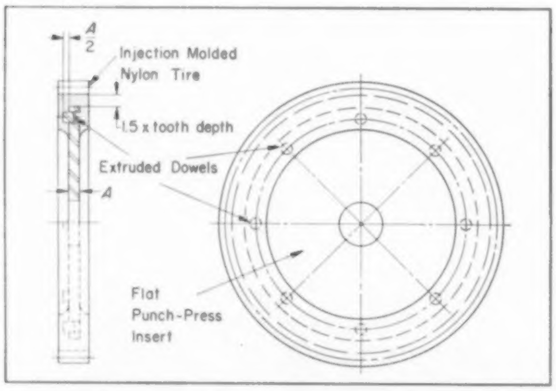
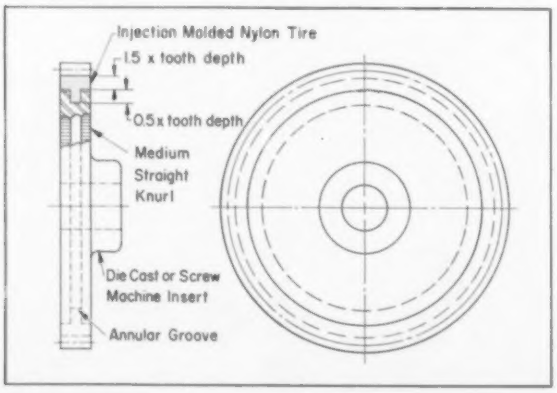


Fig. 3. Inexpensive insert stamping design utilizes extruded dowels to anchor nylon rim.

Fig. 4. Machined or die cast insert has annular groove and knurled periphery to hold nylon firmly.



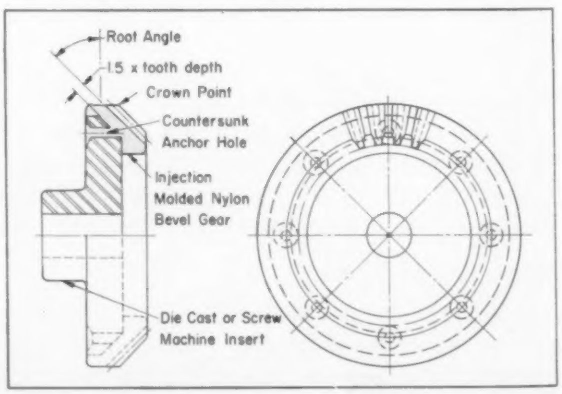
There are a number of recent cases where engineers tried to economize in design and production of nylon gearing and, in so doing, got into trouble. Another case involved an automotive accessory where the designer, in an effort to realize the maximum savings, did not follow the molder's recommendation for face width of the gear. He reduced the width by approximately 25 percent of that recommended. After six months the company began to experience field failures. As a result, the company not only increased the face width but also changed the geometry of the gear teeth to give a much higher beam strength. Troubles in the field ceased immediately.

While nylon is an excellent material for gears, bearings, cams and similar parts, it is not as good a space filler as metal which is less sensitive to climatic conditions. Nylon absorbs moisture and swells approximately 0.012 inch per inch when subjected to prolonged exposure at 100-percent relative humidity. Also, the thermal coefficient of expansion, within normal operating ranges, is about 8.5 times greater than steel.

Metal Inserts: A large gear or part made entirely of nylon is greatly affected by climatic conditions. A nylon bushing, for instance, with a thick wall, as shown in *Fig. 2b*, when confined in a metal retainer, will change its bore diameter at a greater rate than the one shown in *Fig. 2a*. If the gear, *Fig. 2c* and cam *Fig. 2d*, were not made with inserts, they would be much more susceptible to climatic changes and would have less dimensional stability. Whereever accuracy and dimensional stability is essential, inserts should be given consideration even though the cost is increased. A wise choice must be made between a more costly but more stable part containing a metal insert and a cheaper but less stable part made entirely of nylon.

Metal inserts can usually be made cheaply and, when proportioned correctly, can add rigidity to the nylon gear. It is often possible to increase load-

Fig. 5. Practical design of insert for supporting and anchoring molded bevel gear.



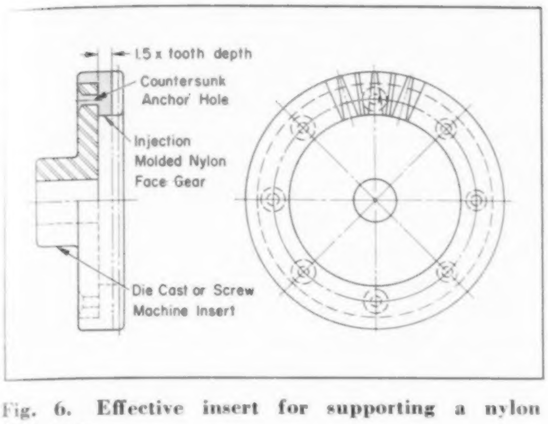


Fig. 6. Effective insert for supporting a nylon face gear.

carrying capacity by the use of inserts. *Fig.* 3 illustrates a flat sheet metal insert made of a stamping and molded into a nylon gear. Attachment of the stamping to the nylon tire is effected by extruding slugs from the metal part to form a series of dowels. The insert can be produced in one operation in a compound die and is relatively inexpensive.

The nylon envelops the insert at the rim and is restrained against torsion by the extruded dowels. Proportions shown should be considered a minimum and are for the purpose of outlining a principle. Other design conditions may prescribe variations which may work as well. As an example, splined notches stamped around the periphery of the insert may be used. This is not as good as dowels because a notched rim tends to introduce localized internal molding stresses.

Another version of a metal insert is illustrated in *Fig.* 4. In this case the insert is made in a screw machine in which an annular groove is machined to restrain the nylon tire laterally. The periphery is provided with a medium, straight knurl to resist torsion. Inserts of this type are desirable where a hubbed gear is required which must be held on a shaft either by a setscrew or a tapered pin. In gears of this type a metal insert is essential because it is not practical to use a setscrew or tapered pin in nylon, because it tends to cold-flow and would cause the screw or tapered pin to loosen.

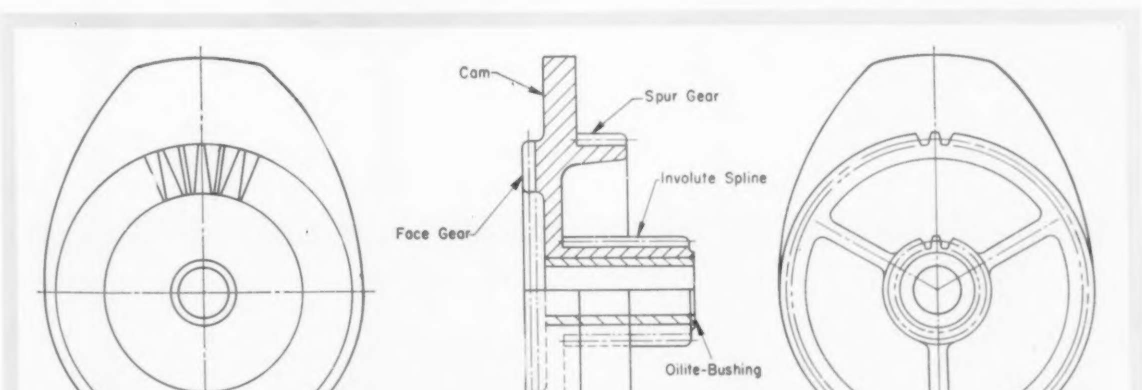
A bevel gear molded on a metal insert is shown in *Fig.* 5. While injection molded bevel gears are relatively rare there is no reason why they cannot be produced if proper care is taken with the production of the cavities. In adapting this bevel gear for injection molding, the back angle, normally found on machined bevel gear blanks, has been eliminated. Instead, the outside diameter, which is fixed at the crown point, is parallel to the axis as in spur gears. This is desirable to simplify the ejection of the part from the mold.

It is especially desirable to support the teeth of a molded bevel gear with a metal insert. The reason for this is that force components are both normal to the pitch cone element and to the axis of rotation. The teeth therefore not only tend to bend in the direction of the axis of rotation, but also in the direction normal to the pitch cone. This is unlike spur gears. An insert made as shown will add rigidity to the gear blank and support the teeth at the point of greatest pressure.

The insert shown in *Fig.* 5 could be a zinc die casting where production requirements would warrant. In this case the anchor holes could be cast with the retaining countersink used to hold the nylon tire to the beveled face of the insert. The insert can be produced on a screw machine when production requirements do not warrant the cost of a die casting mold.

An insert adapted to a nylon face gear is shown in Fig. 6. As in the bevel gear, shown in *Fig.* 5, the force components of a face gear, which is a member of the bevel gear family, are in two directions. One

Fig. 7. Injection molded cluster with powder-metal bushing.

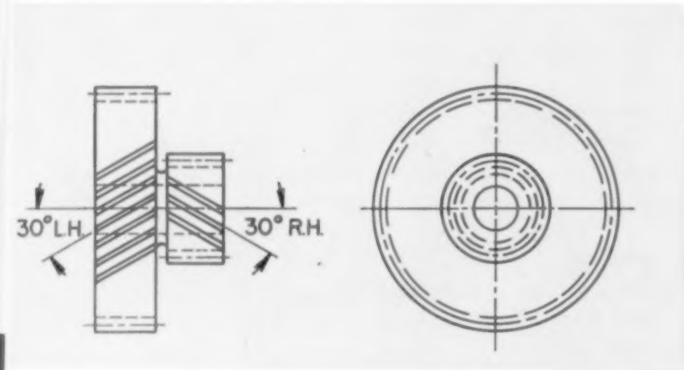


is in the direction of the axis and the other in a direction normal to the tooth surface. The construction shown adds to the rigidity of the gear and enables it to carry a greater load. It also contributes to dimensional stability.

Gear Clusters: The greatest savings in injection molded parts can be realized when several components can be combined in one cluster, as shown in *Fig.* 7. In this cluster, which is an example of current production, a cam is combined with a spur pinion, a spline and face gear. Dimensional accuracy was desired compatible with economy. The bore tolerances were very close. Due to the construction of the part it would have been difficult, if not impossible, to produce a straight bore since the cooling rate of the part varied along the bore. The solution to this problem was the use of an Oilite bronze bushing used as an insert.

This is a case where a considerable saving was effected by combining several parts. The cost of the Oilite bushing represented a minor cost consideration compared to the total savings effected. A much better product was obtained by not attempting to realize savings at the sacrifice of quality.

Sometimes engineers design gears that are difficult to produce by injection molding. *Fig.* 8 is a double helical gear. This gear cluster consists of a pinion and gear member having teeth of the opposite hand. While it might be theoretically possible to mold teeth in such a cluster by a complicated three-plate mold, it is not practical to do so. If it



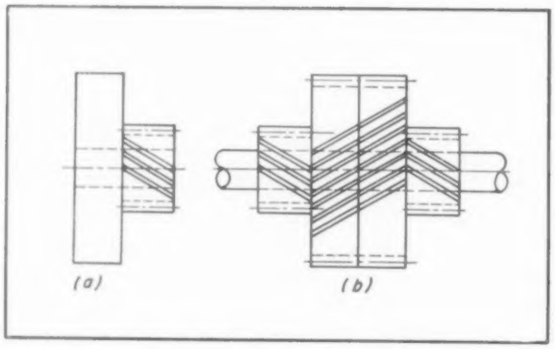
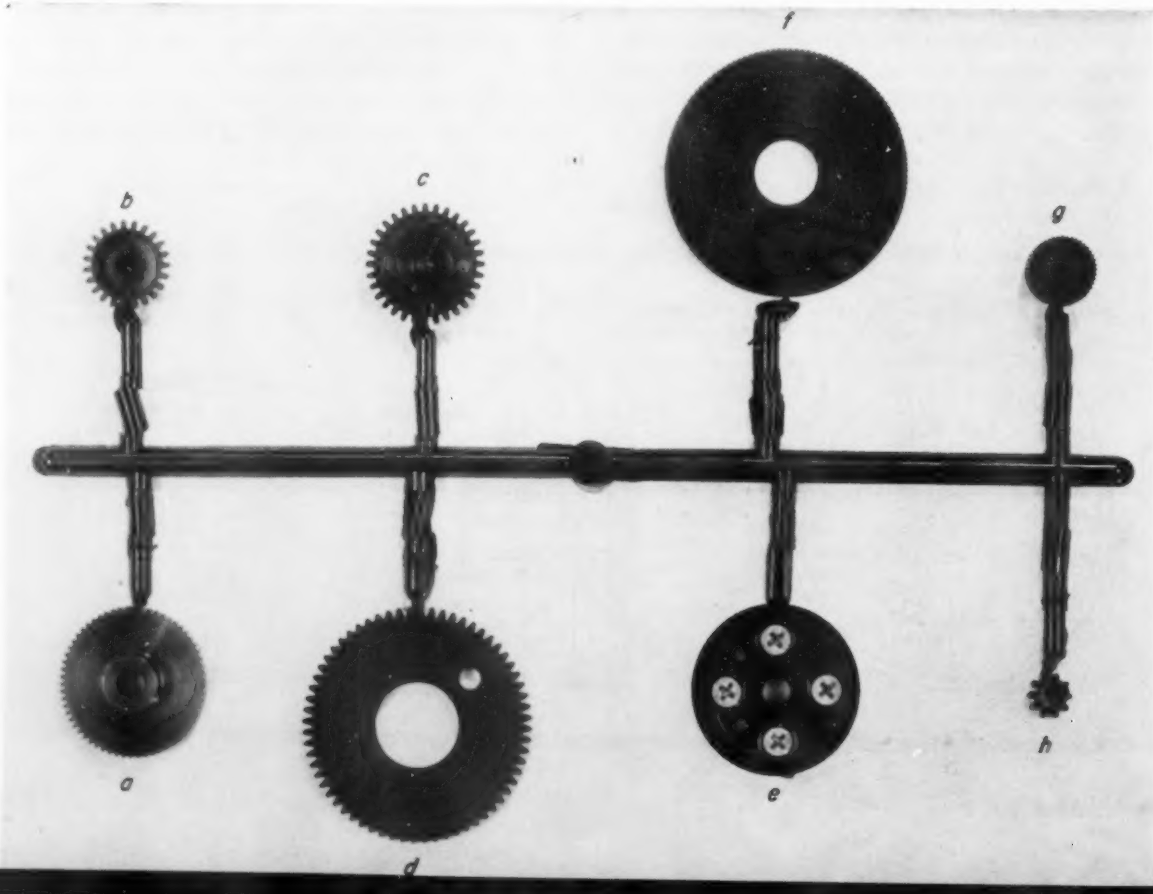


Fig. 8. (top left) Impractical design of gear cluster having both right and left-hand helical gears.

Fig. 9. (center) Cluster shown in *Fig.* 7 may be molded with completed pinion teeth but with gear blank as at *a*. Then gear teeth may be generated on two blanks back to back as at *b*.

Fig. 10. (below) Family molds for gears of different sizes do not produce high-quality gears.



...re possible to produce the teeth on both members with the same hand and lead, there would be no problem since the part could readily be ejected from the mold. A simple mold construction would result. If it were imperative to produce the teeth as shown in *Fig.* 8, then the best compromise would be to produce a gear blank as shown in *Fig. 9a* where only the pinion teeth are molded. The gear teeth could then be generated by the hobbing or gear shaper method, cutting two parts back-to-back, as shown in *Fig. 9b*. This procedure will effect a good compromise between what can be obtained at a reasonable tool cost and what is required to meet the drawing specifications.

Die Design: Compromises in molding techniques are often risky and generally result in an inferior product. *Fig.* 10 shows a cluster of eight gears on its sprue. This cluster represents a so-called family mold because a number of different cavities are joined together by a common sprue. When the production volume is small it is not economical to make more than a single cavity for a part. In such a case it has been common practice to resort to family molds like the one shown.

These molds do not produce the accuracy that can be obtained from a multicavity mold of the same part. It will be seen that the 9-tooth pinion, *Fig.* 10*h*, is much smaller than the gears shown at *Fig.* 10*d* and *e*. It is difficult to insure that, in a given period of time, the exact relative proportion of material will reach all cavities. The conditions which contribute to accuracy are further complicated by the fact that the cooling rate of the small parts, and consequently the polymerization process, is faster than that of the larger parts.

Even if it were possible by trial and error to work out a relative gate size which would insure the right proportions of the viscous material reaching each cavity, the differential in cooling rate would defeat the accuracy requirements in a family type mold. When it must be used, because of economical necessity, the limitations of the process must be taken into account.

A number of arguments in favor of balanced gating have been advanced by plastics engineers. Some of these arguments sound logical and plausible. When subjected to the test of production procedures they do not seem to bear out the theoretical advantages. One of the objects of balanced gating is to obtain a quick and uniform filling of the cavity, thus avoiding surface blemishes. The trouble is that it is extremely difficult to make all the gates exactly alike volumetrically so that each point receives the same amount of material at exactly the same condition of temperature and viscosity. Attention to proper venting of the cavity is much more important.

One manufacturer had a problem with the teeth of an eleven-toothed helical gear. One of the teeth was filled incompletely. He concluded that the material was not reaching the cavity fast enough. He therefore gated all of the eleven teeth. This did not solve his problem, so he tried eliminating one gating point after another without results until he had only one left. This still did not eliminate the voids on a particular tooth. He next tried multiple gating on several selected teeth, also without results. When he gave more attention to the venting of the cavity, and to lowering the viscosity of the material by increasing the temperature, he eliminated his trouble. Today this part is being molded by pinpoint gating on one tooth at a temperature about 50 deg Fahrenheit higher than originally used.

Venting and molding temperatures cannot be predetermined. They oftentimes pose problems that can be solved only by experimentation.

Surface blemishes sometimes occur around depressed or raised letters in a part. The letters retard the flow of material in the cavity by acting as deflectors. This condition is not unlike stones in the path of a stream of water. One of the remedies is

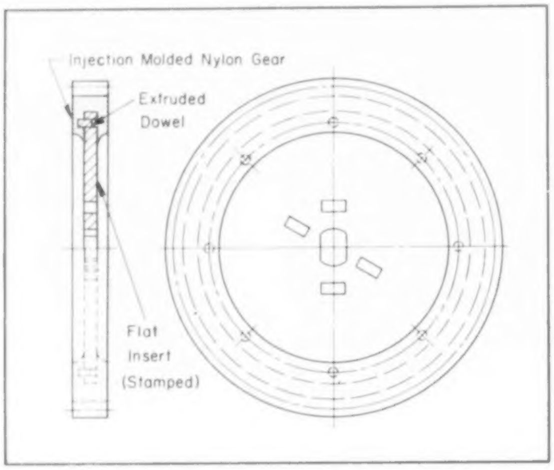
Fig. 11. Holes in hub of nylon gear produce uneven surfaces.

to reduce the viscosity of the material by operating at a higher temperature. Another is to reduce the height and size of the letters or characters. Still another is to connect all of the characters by a fine line, forming a continuous channel. This connecting line can be made an artistic part of the design by subordinating its width and depth to the main characters.

It has been pointed out that, wherever the maximum dimensional stability and strength are re-

quired, metal inserts can be used to good advantage and are well worth the extra cost. Some exceptions are small, highly competitive items like clock gears, where inserts cannot be used because of cost and size considerations of these small parts.

Fig. 12. Metal insert eliminates distortion in design in *Fig.* 10.



Sometimes a cheap metal insert will not only improve the function of the part but also reduce cost. *Fig.* 11 is the hub of an injection molded nylon gear. Because the four rectangular holes around the center hole cause a change in cooling rate in the part, the hub faces are wavy and uneven. The waviness can be seen by the shaded areas around the holes. In this case a simple inexpensive metal stamping, used as an insert like that shown in *Fig.* 12, will eliminate the distortions and result in a better part which can be produced as cheaply. The cheaper, steel center, offsets the material cost of the more expensive nylon even though the mold loading time is considerably greater.

We have just begun to realize the tremendous potentialities of injection molded nylon gears. They are undoubtedly the most promising development in gearing today. Many mistakes have been made by the pioneers. That was inevitable. If well-learned lessons result from those mistakes, the future of this important phase of gearing manufacture is assured and industry will be richer for it.

Mechanized Metalworking Provides Multiple Saving

Change to automatic operations solved two problems for Vulcan Tin Can Co. where can blanking and redrawing work has been mechanized. High rate of rejection of finished parts, plus the problem of accommodating cumbersome space-consuming equipment caused the switch in work methods.

The job, which had been manual, now is performed automatically on a hydraulic press equipped with an index table—both units made by The Denison Engineering Co. The C frame type press has a large open height and is designed to conserve floor space.

Index table action is interlocked through the press' hydraulic system for positive sequence of movement. The table dial is regulated for about 35 indexes per minute. Automatic hoppers feed workpieces to the table while an automatic ejection device disposes of finished parts. Preliminary shells for redrawing are delivered to the table which indexes in positive sequence with the action of the press ram. As each can is redrawn, another is moved into position down the hopper feed. Previous regulation of stroke length, ram speed and tonnage of press assures uniform pressure application for each cycle. A rail mounted above the table catches the part as it moves from the ram station, Motion of the table as it moves to the next position carries the workpiece into a chute.

Approximately 2,000 cans are drawn each hour with the new equipment—and cost savings have been such as to pay for it in only a few months.

To help prevent damage to workpieces, lubricant is sprayed on each part in process.

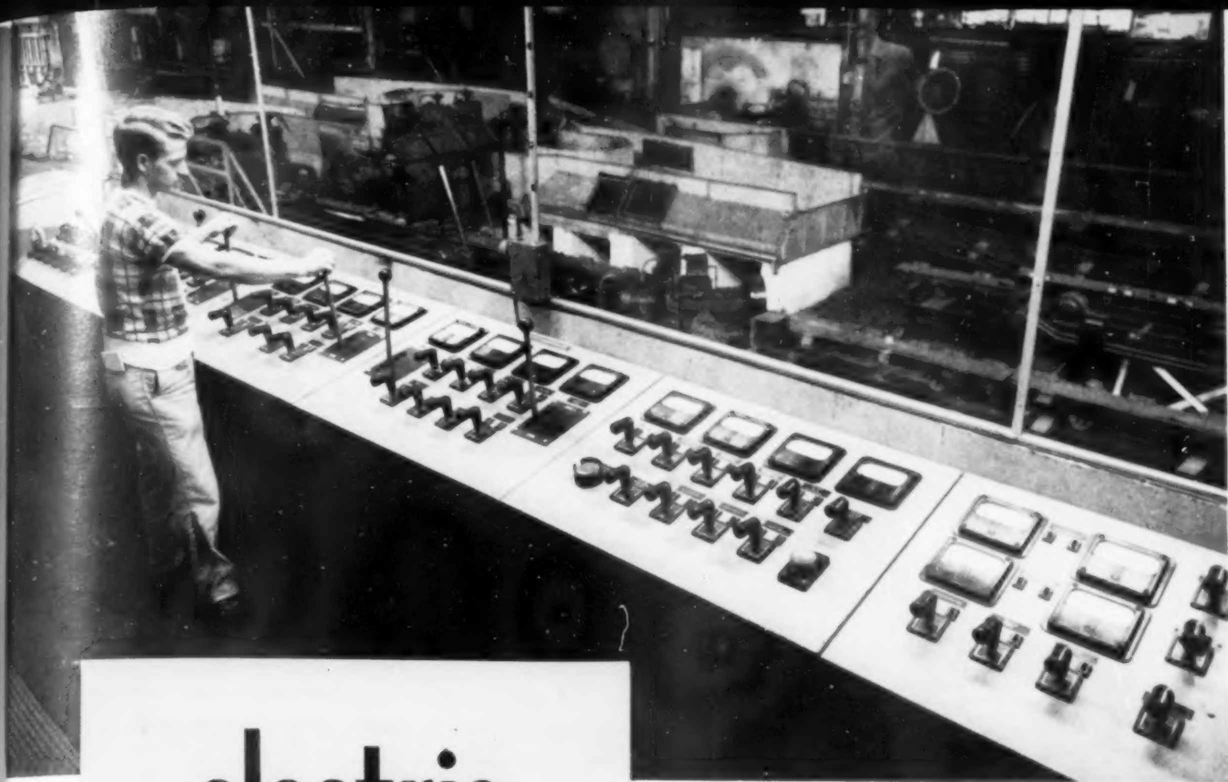


Fig. 1. Remote controls insure safety to the operator and better machine operations.

electric controls

Part 6 Pilot Circuits

By John Ponstingl

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Rapid development of automation, which has already contributed much to progress in industry, is based, to an important degree, on pilot controls and their circuits. When the tool engineer plans to use electrically driven machines or processes, he becomes involved with pilot controls. For this reason a catalogued survey of the more common elements is useful to him.

Many of these controls are solely for the protection of motors and their circuits. While they are important in a complete electric control, this article will discuss pilot controls and circuits which are of more direct concern to the tool engineer and are used in the initiation or operational sequence of a machine tool or process. Such pilot control devices are pushbuttons, limit switches, pressure switches, etc.

Power circuits without pilot controls (commonly called manual controls) require the operator to control the motors or other electrical devices. Such factors as:

1. Variations and limitations in human response
2. Development of fatigue, tension, monotony
3. Inconsistencies in human reactions
4. Inaccuracies and varying sense of judgment
5. Limitations of temperature, pressure, vibration, etc., that the human can stand

not only limit the effective use of manual controls but often decrease the normal capacities of tools, machines and processes, or damage them.

Pilot controls and circuitry have thus been developed not only to provide protection for the motor but also to insure safety for the operator, protection for driven machine, and a definite sequence in machine operation or process. While power circuits connect the electric source to the motors, pilot circuits connect such accessories as pushbuttons, relays, limit switches, etc., in combinations to control the power circuits.

In order to utilize pilot devices, the switches or

Table 1—Range of Commercial Pilot Devices

Signal	Pilot Device	Basic Operation	Typical Application
Motion — Linear	Pushbutton	Insulated button or plunger mechanism is pressed by the operator to open or close a set of contacts.	General, machine tools, etc. Anywhere a circuit is to be initiated by an operator.
	Foot Switch	Similar to pushbutton except operated by the foot.	Same as pushbutton.
	Limit Switch	Lever or rod mechanism is operated to open or close contacts.	Machine tools, automatic machines, elevators, cranes, etc.
Rotating	Limit Switch (Cam Switch)	Rotation of a shaft causes cams to open or close contacts. May include gear box where many revolutions are involved.	Automatic machines, programming.
	Traveling Nut	Nut type mechanism travels along a rotating screw to operate contacts.	Automatic machines, hoists, programming.
	Selector Switch	Knobs, handles, or levers are turned by the operator to open or close contacts.	Similar to pushbutton application.
	Tachometer	Generator (either a-c or d-c) connected to machine. Output voltage represents machine speed.	Regulating systems in machine tools and automatic process lines.
	Centrifugal Switch	Governor, or other speed sensing device, actuates contacts.	Control plug stopping of electric motors on machine tools, conveyors.
Memory	Mechanically-held or latched in devices	Pushbuttons, relays, etc., featuring maintained type contacts respond to a signal and hold that condition until another signal is impressed.	Machine tool processes, automation.
	Relays with holding circuits	Relays lock themselves in with their own contacts when energized.	General, machine tool and processes, automation.
Time	Pushbuttons	Pushbuttons include escapement or dashpot or capacitor discharge to introduce a time delay after the button is operated. Some maintained type pushbuttons include a delay action to convert the button to a momentary type after an interval.	Used in processes where manual operation is necessary and a fixed time delay is still desired. Used to provide maintained contacts on voltage dips and momentary contacts on power failure.
	Timing Relay	Relay includes time-delay mechanism so that contact action is delayed either on energization of the relay or de-energization.	Automatic machines, processing, etc.
Temperature	Thermostat	Temperature actuates bimetal, fluid in bellows or bourdon tube to operate contacts.	Motor overload protection, automatic processes, heating and ventilating.
Electrical — Current	Current Relay	Operating coil of relay is designed to function for a particular flow of current through the coil.	Overload protection, load sensing in batch processing systems, etc.
	Contact Making Ammeter	Similar to relay except designed for very low currents (microamps).	Same as current relay.
Power	Contact Making Wattmeter	Contacts are operated by wattmeter mechanism.	Same as current relay.
Power Factor	Contact Making Power Factor Meter	Contacts are operated by power factor meter mechanism.	Automatic control of synchronous motor field. Automatic control of capacitors for power factor correction.
Resistance	Bridge Circuit and Relay	Resistance to be measured is in one leg of a bridge circuit. Relay or other device detects change of resistance.	Temperature measurements by resistance, follow systems, servo systems, regulating systems.
Voltage	Voltage Relay	Operating coil of relay is designed to function at a particular voltage.	Control circuitry.
Fluid — Humidity	Humidistat	Element sensitive to humidity operates switch.	Air conditioning.
Liquid Level	Float Switch	Float mechanism senses liquid level to operate contacts.	Automatic processing systems, sewage and waste disposals, liquid level control.
Pressure	Pressure Switch	Pressure of medium actuates diaphragm, bellows or bourdon tube to operate contacts.	Compressors, hydraulic systems.
Vacuum	Vacuum Switch	Pressure of medium actuates diaphragm, bellows or bourdon tube to operate contacts.	Vacuum systems and processes, pneumatic conveying.
Visual — Light	Photoelectric Control	Photoelectric cells or tubes initiate sensitive relays or electronic circuits to operate contacts.	Limit switch applications, automation, process lines, printing and register regulators.

ntacts in the power circuit must be included in a agnetic contactor, pneumatic contactor with electic solenoid or a motor-operated contactor. These rcuits may be operated in response to either the ignal of an operator's finger upon a pushbutton r to a signal supplied automatically by a device esponsive to a chosen variable such as time, temperature, pressure or position of tool or workpiece.

Basic Types of Pilot Devices

Pilot controls have been designed to duplicate practically all of the senses so as to impart as much intelligence as possible in an electric control. TABLE 1 outlines the basic types and features of commercially available devices which respond to particular signals, producing some form of electrical reaction such as closing a set of contacts or producing an output voltage which in turn can be fed to a control relay or another control device.

Pushbuttons: While pushbuttons and selector switches are akin to manual controls, the heavy power circuits are not directly controlled by the operator. They permit remote control operation, *Fig.* 1, as well as isolation of power circuits. A high-voltage motor and control applied to a large air compressor could be located in the basement of a plant, and controlled from one or many points throughout the plant by means of a low-voltage control circuit and pushbuttons. A wide range of features is available in commercial pushbutton units. Pushbuttons and selector switches (also master switches) are basically the only pilot controls linking the operator with electric controls.

Limit Switches: Most other devices shown in TABLE 1 differ in the mechanisms used to open or close the control contacts. *Fig.* 2 illustrates typical mechanisms used to operate a normally open control contact. Limit switches, either cam or lever operated, are used to indicate travel or position of moving parts and to initiate new movements of other parts. Also, limit switches can be made to close when a workpiece is properly located in a machine, so that it is inoperative unless the work is properly positioned.

Limit switches are available with lever operators, plunger, fork levers, rope, sprocket, chain, or roller operators. Some types can be made to operate in a 0.001-inch movement and others in several inches or degrees of rotation. The contacts are either slow moving or snap action. Slow make-and-break contacts can be used for most general-purpose applications. For machines having extremely slow motion or short drifts (after stopping) a snap-action switch should be used.

Float Switches: Chain or rod-operated float switches are used to indicate liquid levels in wells, tanks, etc. On a given level signal, they operate magnetic starters, which in turn start or stop motor-driven pumps or other machines. Electronic devices are available using a set of electrodes or probes to detect levels of materials.

Pressure Switches: Pressure switches are used to indicate changes of pressure occurring with either liquids or gases. A given pressure change actuates a bellows or bourdon tube which in turn operates a precision-switch mechanism. This, by pilot circuit connection, operates a magnetic starter which then puts a pump or some other machine into action.

Temperature Controls: Like pressure switches, temperature sensitive units may involve a bellows mechanism or bourdon tube which is actuated by expanding or contracting gases. Some units use bimetals. The signal to which they respond is temperature change.

Magnetic Control Relays: These are used for interlocking and sequencing of multimotor machines by remote control. They are also used for remote control of electrical circuits from a single point such as a pushbutton station, a limit switch, a thermostat, pressure control or some similar device. Relays are available for every purpose. They can be single contact or multi-contact, either normally open or normally closed or combinations to control a multiplicity of circuits. Other mechanisms can be incorporated in addition to the operating magnet to make up timing relays, latched-in relays, ratchet-sequence relays, etc. Many designs are available, such as general-purpose, miniature type, high-sensitivity type, close differential, etc.

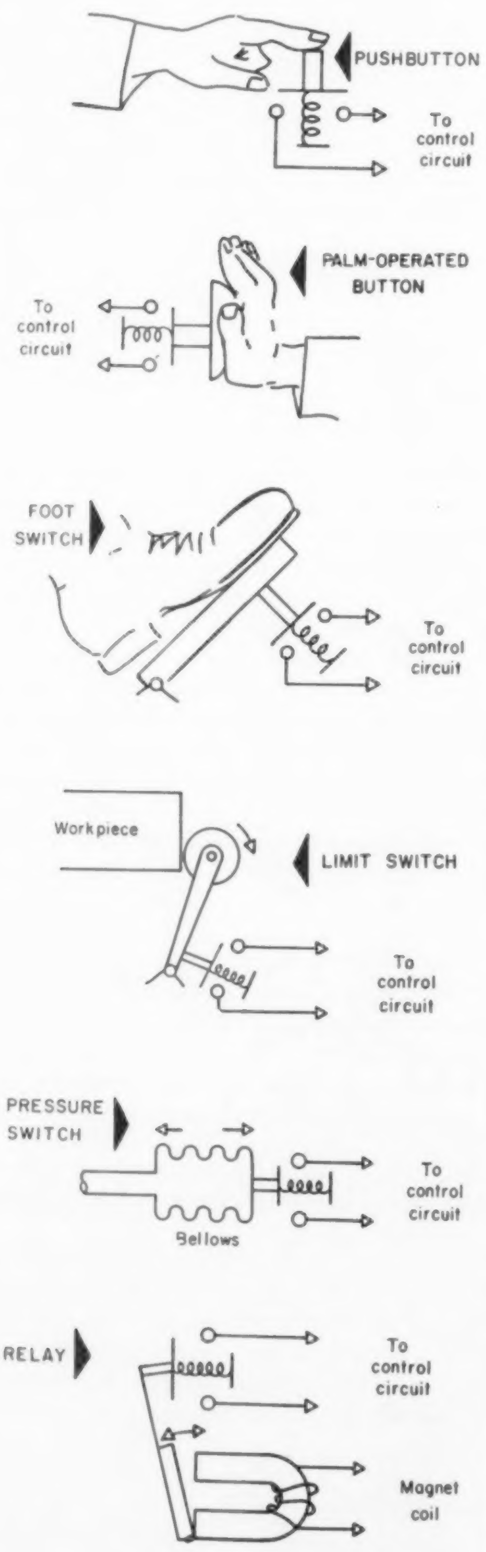
Master Switches: Sometimes called drum controllers, master switches are generally used in connection with magnetic starters as substitutes for pushbutton stations. However, they can also be used, without magnetic starters, as manual controls on applications not requiring overload protection or low-voltage protection. They can be used for speed changing on multispeed motors and to provide reversing as well as regular operation of single-speed motors.

Proper selection of a pilot device depends on the type of signal that is used to operate the device. If a thin material such as paper is to initiate a limit switch, a photoelectric-type system may be the only answer. The desired range of operation, sensitivity and accuracy also narrow the choice of pilot control devices.

Basic Circuits

Circuits frequently become complicated when they must perform a multiplicity of sequencing operations in a particular application. Actually, however,

Fig. 2. Simplified representations of mechanisms for pilot controls.



all schemes are made up of a few basic contact arrangements.

Contacts on pilot controls are either normally open or normally closed, and either momentary or maintained type. When the proper signal is applied, these contacts then assume the opposite position. If they are of the momentary type, they assume their original status when the signal is removed. If they are of the maintained type, it requires another signal or operation to reopen or reclose the contact. Characteristics may be designed into the devices so that a time delay occurs after the signal and before the contacts operate. *Fig.* 3 shows symbols for the most common types of contact arrangements available. JIC and NMTBA use these symbols.

A simple application using momentary contacts is shown in *Fig.* 4. When the pushbutton is pressed, a circuit is complete to coil *M*. Since this is a three-pole contactor, the three contacts close to energize a three-phase motor. When the button is released, the *M* coil is de-energized and the *M* contacts open to de-energize the motor. This represents a typical circuit used for inching or jogging a motor.

Holding Circuits

Momentary contacts can be combined into a holding circuit as shown in *Fig.* 5. When the pushbutton is pressed, coil *M* is energized, and all the normally open *M* contacts (not shown) close. When the pushbutton is released, the pushbutton contacts open but the circuit to the *M* coil is not interrupted as before, because the auxiliary *M* contact provides the holding circuit to the coil.

The circuit remains energized until the control voltage reduces to a value where the *M* coil no longer has sufficient power to hold in the moving armature of the contactor or relay. This may be approximately 60 to 70 percent of normal voltage depending on the design of the device. This value is termed the drop-out voltage. Another method of de-energizing this circuit is to include a normally closed contact, or "stop" pushbutton, as shown in *Fig.* 6. This is commonly called a 3-wire circuit.

Low-voltage protection is a term applied to this control scheme because it prevents unexpected and unsupervised restarting of a motor after it has been stopped because of low voltage or power failure. Such a scheme makes it necessary for the operator to press the "start" button to re-energize the motor regardless of whether the motor has been stopped by voltage failure, operation of the stop button or operation of the overload relay (overload relay contact is put in series with "stop" button).

A basic circuit using a "maintained" contact is known as the 2-wire pushbutton circuit or low-voltage release circuit. Since the pushbutton remains closed after the "start" button is pressed, the motor will continue to run until the "stop" or latch-release

button is depressed. In the event of a voltage failure, the contactor will drop out, but on resumption of power, the contactor will be energized and the motor will restart. Pushbutton contacts can be replaced with any other type of pilot control having the same contact characteristics and still effectively produce the same fundamental circuits.

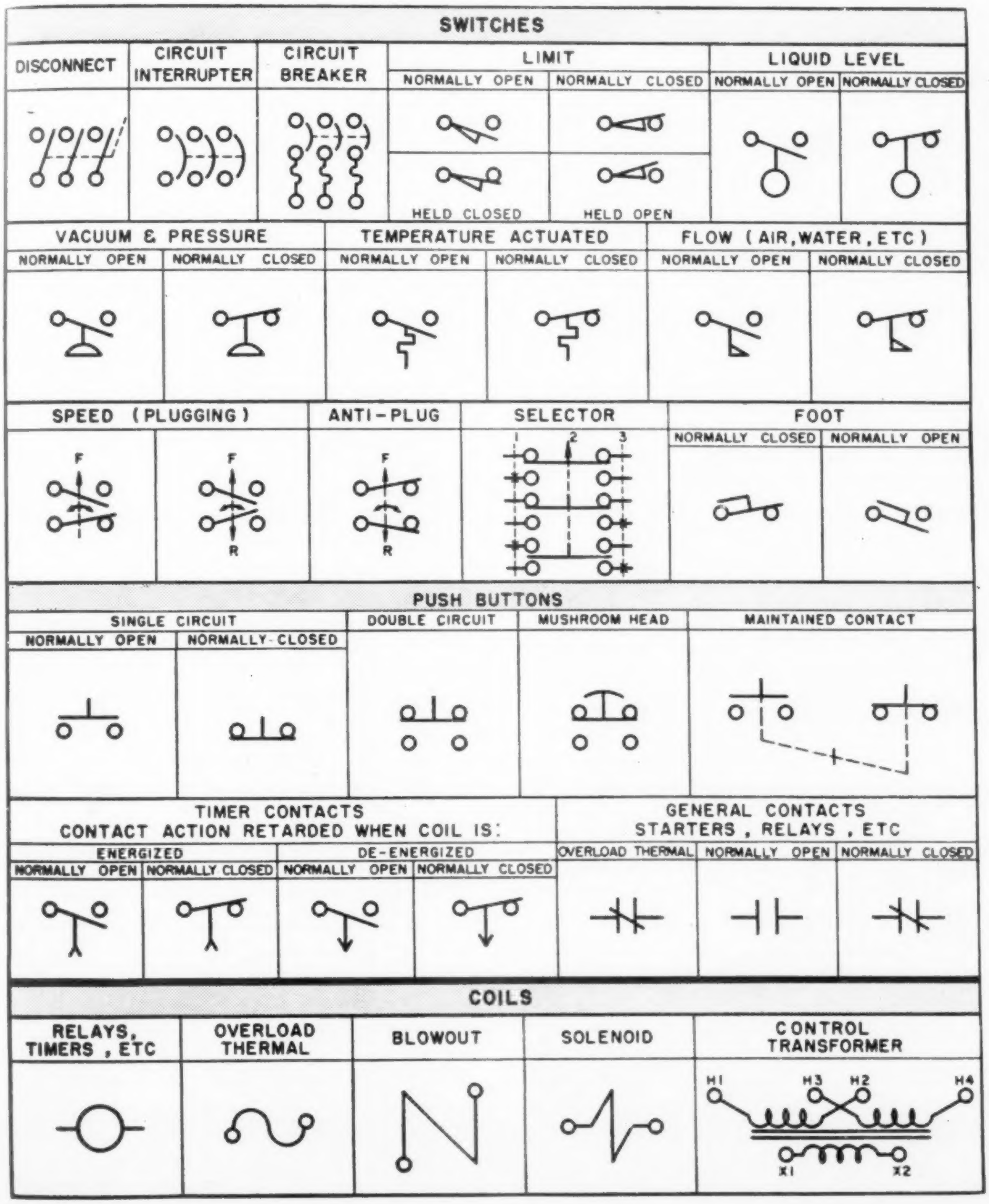
Basic Limitations

Most control contacts are rated for continuous current of 10 amperes, a-c. The maximum interrupting rating or the maximum inductive currents that may be safely interrupted at a given voltage for typical contacts are shown in TABLE 2. Standard-duty contacts are on the low end of the current range and heavy-duty contacts usually on the higher end.

Since magnetic contactors are so widely used, it is worth mentioning certain inherent characteristics which offset the control-circuit design. A magnetic contactor can be operated by a d-c or an a-c energized electromagnet.

In a d-c operated contactor, for example, a certain voltage is applied to the coil with the coil current being limited by the resistance of the coil. As the contactor size increases, the electromagnet and re-

Fig. 3. Graphical symbols for control contacts on various devices.



sulting power to the operating coil increases, as shown in TABLES 3 and 4. The fact that the current flowing in a d-c magnet coil is limited by the resistance only means that the inrush and steady-state (open and closed gap) currents for a d-c coil on a contractor will normally be the same. Because the open-gap pull on a magnet is less than the closed-gap some very large contactor coils are specially designed for a lower voltage than that used in the control circuit, permitting a heavy inrush current giving a high magnetic pull at the start. In instant the contactor closes, a resistor is inserted in series with the contactor coil to limit the current to a value which will not overheat the coil.

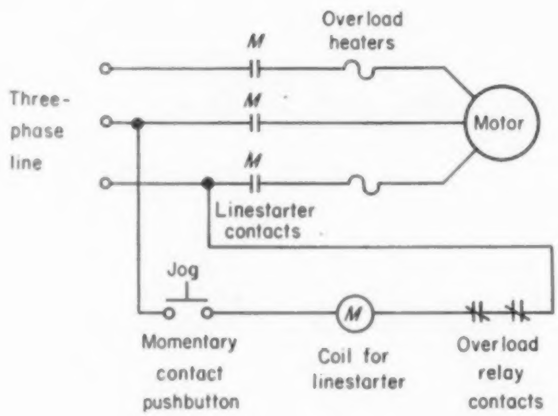


Fig. 4. Momentary pushbutton circuit with magnetic linestarter, provides motor jogging.

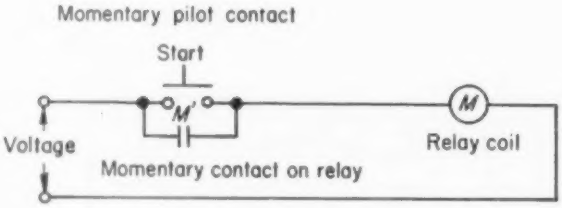


Fig. 5. Momentary contacts combined to make a holding circuit with low-voltage protection.

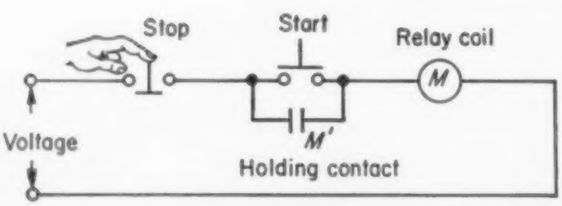


Fig. 6. Circuit using normally-closed contacts to de-energize holding circuit.

While the current in d-c coils is determined by the resistance of the coil, the current in a-c coils is determined by the impedance of the coil. Since the open gap of the contactor magnet produces a low value of inductance in the operating coil as compared to the closed gap, the impedance of the operating coil is low when the contactor is first de-energized and high when the contactor-armature is fully closed. The impedance may change as much as 1 to 10. For this reason, the power demand or current of an a-c coil will have two values; namely, inrush or open-gap current (volt-amp) and holding or closed-gap current (volt-amp) as shown in TABLE 4.

In addition to influencing the type of pilot device used to control the various a-c contactor coils, the coil burdens also influence the voltage source that supplies power to the coils, particularly if the source is a control transformer. As an example, suppose a control transformer had to be selected for use with a 100-amp 3-pole contactor. On the basis of 170 volt-amp closed-gap burden, a 200 volt-amp control transformer certainly would appear to be satisfactory from a steady-state point of view. (Transformer would be operating at 85 percent full load.) At the instant the contact coil is energized, however, the coil burden is 1100 volt-amp and would represent 550 percent of the rated load of the transformer. If the transformer regulation were low, then this 550-percent load could pull the transformer output voltage below 75 percent rated voltage. Most commercial a-c contactors are not guaranteed to pull in at such a low voltage; consequently the contactor armature would never pull in. It would remain open, drawing this excessive 1100 volt-amp until the coil burned out. The transformer must be capable of maintaining its secondary voltage during the high coil current inrush.

Table 2—Inductive Current Ratings for Pilot Control Contacts

Operating Voltage (volts)	Continuous Rating (amp)	Interrupting Rating (amp)
Alternating-Current Supply		
110 to 125	10	30 to 70
208 to 250	10	15 to 35
440 to 480	10	7 to 15
550 to 600	10	5 to 10
Direct-Current Supply		
115 to 125	10	0.5 to 2*
230 to 250	10	0.2 to 1
550 to 600	10	0.2 to 0.4

*Contact designs are available with blowouts to permit d-c interruption ratings up to 10 amp.

Table 3—Power Demands of D-C Coils on Contactors

Contactor Rating (amp)	Coil Power (watts)
D-C Contactor, Single-Pole	
5	10 to 20
10	10 to 20
25	10 to 20
50	15 to 20
100	22 to 31
150	23 to 31
300	41 to 65
600	170 to 186
900	170 to 186
1350	340 to 385
A-C Contactor, Three-Pole with d-c magnet	
50	50
100	90
150	90
300	90
600	200
750	200
1200	200

Table 4—Power Required by Coils of Three-Pole A-C Contactors

Contactor Rating (amp)	Power Frequency (cps)	Power Required by Coil: Inrush (volt-amp)	Holding (volt-amp)	Holding* (watts)
25	25	85	23	8
25	60	165	30	7
50	25	235	36	6
50	60	550	85	17
100	25	600	110	20
100	60	1100	170	32
150	25	700	130	25
150	60	1300	200	40
300	25	1550	245	60
300	60	3850	648	225
600	25	6920	770	115
600	60	17800	1980	340
750	25	6920	770	115
750	60	17800	1980	340
1200	25	6920	770	115
1200	60	17800	1980	340

*Actual power consumed by coil contrasted with apparent power (volt-amp).

Good Pilot-Control Circuits

Experience, ingenuity and a practical sense are important factors in designing circuits for a particular application or process. Some rules which should be considered in control circuitry are as follows:

1. Keep circuits as simple as possible.
2. Connect one lead of all coils to one line and keep all pilot contacts in the other line, leading to the coils, to eliminate sneak circuits, except where double contacts are used such as for disconnecting both sides of a solenoid coil.
3. Design circuits to fail safe, that is, use contact arrangement that will not tend to start a movement or operation when the relay or contactor coils fail, wires break, or are grounded.
4. Provide sufficient limit switches to properly indicate completion of starting of all movements in an automatic operation.
5. On complicated automation systems, use relay contacts rather than limit switches or other pilot devices to control solenoid coils. This permits convenient checking of operating sequences.
6. On automatic systems, use low-voltage protection circuits wherever possible to prevent accidental restarting after a voltage failure.
7. Do not connect different-sized d-c contactor or relay coils directly in parallel. The discharge current from the larger coil may cause the smaller coil to hang on.
8. Fuse devices against short circuits which may damage or cause false operations of the devices (or provide a ground detector system).
9. Don't depend on one standard relay to pick-up faster or drop-out faster than another, to provide a sequencing operation.
10. Design with safety and good maintenance in mind.

With these basic principles in mind, a control system may be analyzed readily to ascertain its operating and protective features. In practice, a process or operation is no better than the accuracy and effectiveness of its controls.

Nylon Additives Improve Plastic Die Qualities

ABRASION RESISTANCE has been improved and service life extended for plastic drawing dies and tooling by the simple expedient of introducing powdered nylon into epoxy and phenolic resins. The nylon additive in itself is not abrasive. National Polymer Products, Inc., which reports on the altered process, has found that the addition of 10 to 25 percent of powdered nylon improves epoxy resin abrasion resistance by about four times.

Furthermore, the additive acts as a suspending agent to other metallic fillers, often included in the formulae of such epoxies to prevent exotherms. Tests indicate that adding 10 parts of powdered nylon will suspend 100 parts of iron, copper or brass in 100 parts of epoxy resin. When the powdered nylon was not used, as much as 20 parts of the metallic filler settled out before the product cured.

designed for PRODUCTION

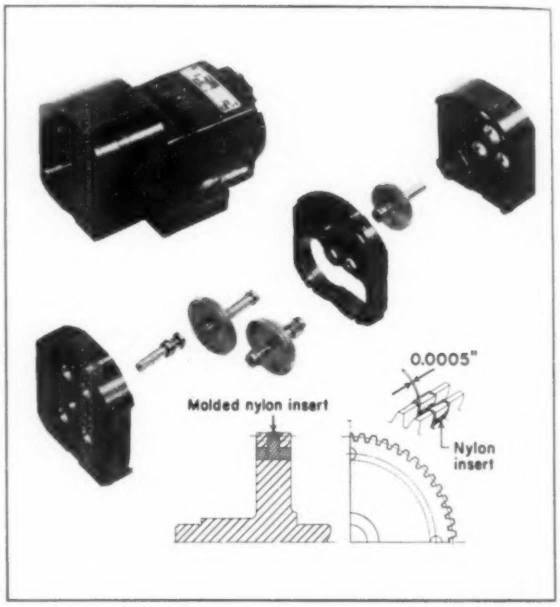
Solution to Gear Backlash

Backlash in gear trains used for precision control in aircraft, ordnance, radar and research equipment has always been a troublesome problem—especially when friction torque must be minimized and it is imperative that the gears operate in both directions with equal facility.

In any but the simplest installation, adjustable bearing mountings are impractical. Split gears having spring-loaded segments operate satisfactorily in one direction of rotation but not in both directions. When center distance is closed to practically an interference fit, torque is increased objectionably.

What has proved to be a successful solution to this problem is the Min-a-lash gear developed by Dexter Machine Products, Inc., Chelsea, Mich. These gears have a central lamination or wafer of nylon flanked on both sides by steel. The blanks are cut and shaved by conventional methods.

After cutting, the nylon portion of the gear grows slightly to increase tooth thickness enough to reduce backlash to a negligible amount—without increasing torque loss. The inner nylon portion does not assume any of the gear load. Load is taken entirely by the outside steel portions.



MINIMUM BACKLASH is achieved in this gear box by using gears with central nylon inserts. The gear box has a 90:1 ratio and an output torque rating of 30 oz-inches. Although 1.0 oz-inch friction torque is permissible for this application, it is held to 0.375 oz-inch. Backlash of the complete train measures only 0.02 degree.

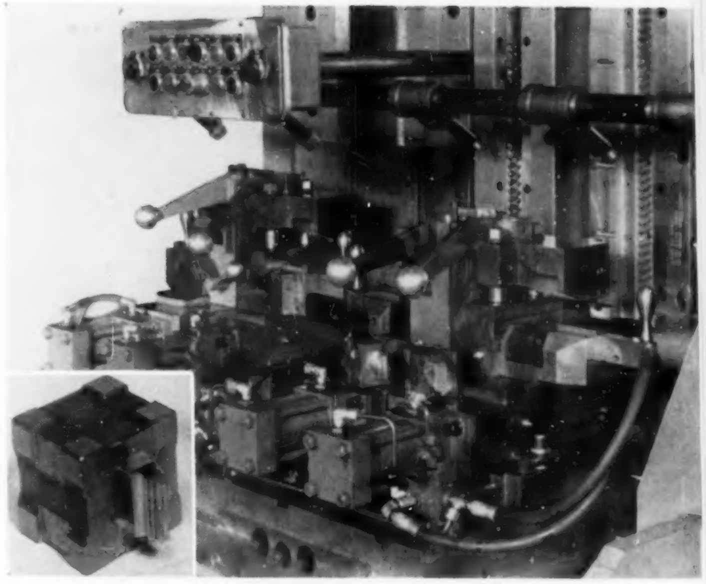
Broaching Stellite with Carbide Tools

Absence of a series of long runs makes the estimate of tool life difficult but acceptable parts were obtained throughout a 1200-part run without regrinding the carbide tools. Although trouble has been experienced with tool edge breakdown and welding of the carbide to the workpiece when broaching Stellite with carbides, the Detroit Broach Co., Inc., Rochester, Mich., designers and builders of this machine and its tooling, have not had these problems arise during production with this setup.

Rigidity of the machine, piston rods used in tension, and positive location of workpieces and slides are advanced as reasons why such troubles have not developed. Acceptable finish is achieved because of these factors and because the main slide oil circuit is used exclusively for moving the slides. The machine knee is operated by a separate hydraulic system powered by a 5-hp motor.

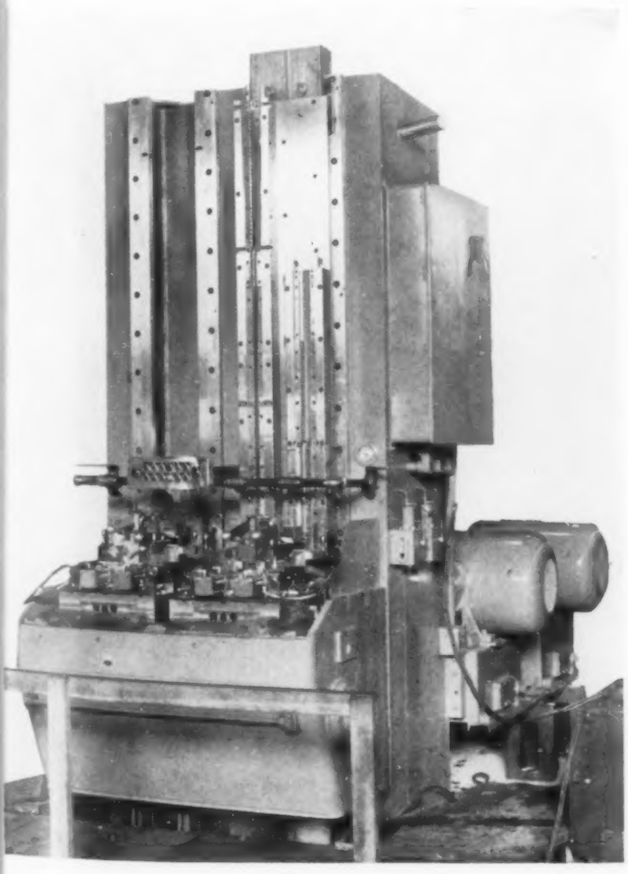
Because reversing pumps are used, there is a minimum of tubing in the machine. What there is, is steel tubing. Flange-type connections are used with dead soft annealed copper gaskets to minimize leakage.

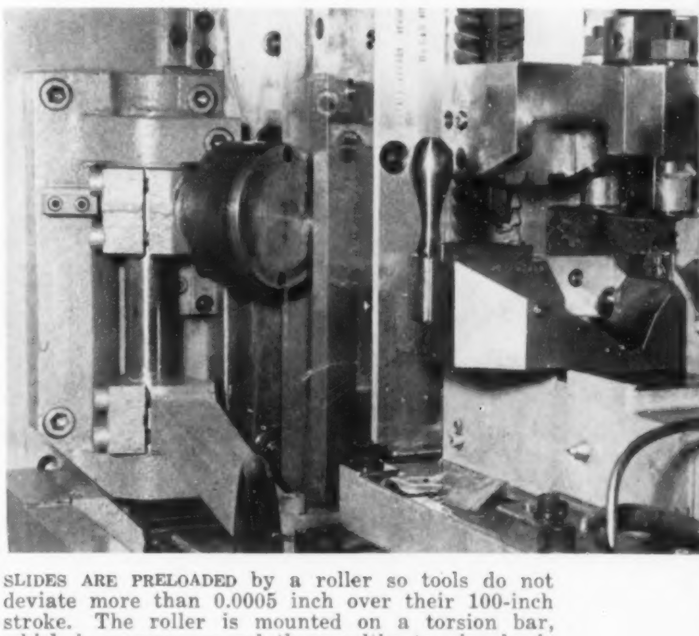
Since it had been noted in the past that broaching machine slides had a tendency to settle overnight and move away from the trip dogs, this machine was designed so the slides automatically orient themselves as soon as the machine is started. This feature removes the possibility of smashing the tools on starting machine.



CARBIDE TIPPED broach inserts (grade K-6) are used in tooling for this particular job. Ram strokes are equal but less tooling is required for lefthand ram operations. The part is mounted in a matrix block (inset) for location only and all load is transmitted by locators in the fixture. The low-melting point matrix metal is invested in the block to hold the bucket in relation to the block. Matrix blocks are mounted in hydraulically operated two-station fixtures, which are in turn mounted on a standard shuttle table. A highly chlorinated coolant with an oil carrier is flooded directly over the tools and workpieces through pipe outlets. Operating controls are conveniently grouped over the fixture.

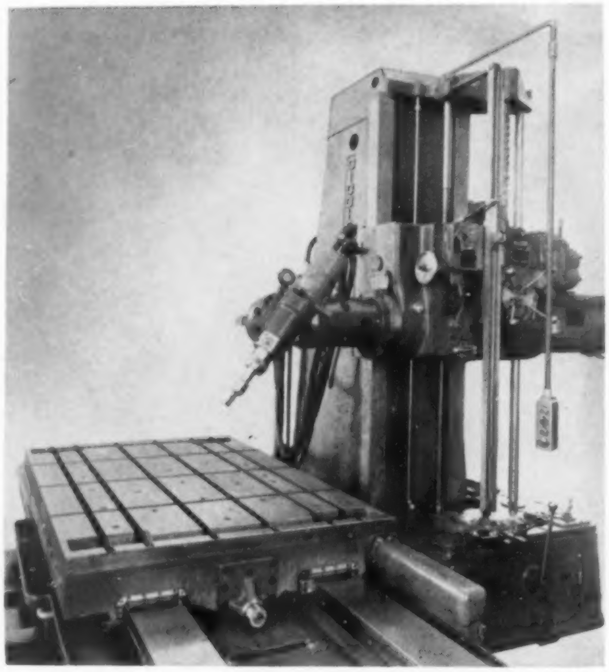
TWIN RAM HIGH-SPEED surface broaching machine tooled with carbide for four operations on Stellite turbine buckets. This 15-ton capacity vertical machine has a cutting speed variable between 8 and 120 feet per minute and an adjustable stroke of 12 to 100 inches. The main Oilgear pumps are powered by two 50-hp motors and higher broaching speeds can be achieved by adding pumping equipment and changing cylinder flanges. The four broaching operations for which this machine is tooled are, right to left: (1) square ends of root, (2) rough and finish Christmas tree root, (3) square tang sides and (4) finish tang bottom.





SLIDES ARE PRELOADED by a roller so tools do not deviate more than 0.0005 inch over their 100-inch stroke. The roller is mounted on a torsion bar, which is sprung several thousandths to give loads of 800 lb back and 1200 lb to the right. This forces the slides against a way and holds them there during the stroke. To broach the AMS 5832 Stellite, generating type cutters remove 0.005 inch per tooth.

Independent Milling Attachment Machines Airplane Wing Hinges

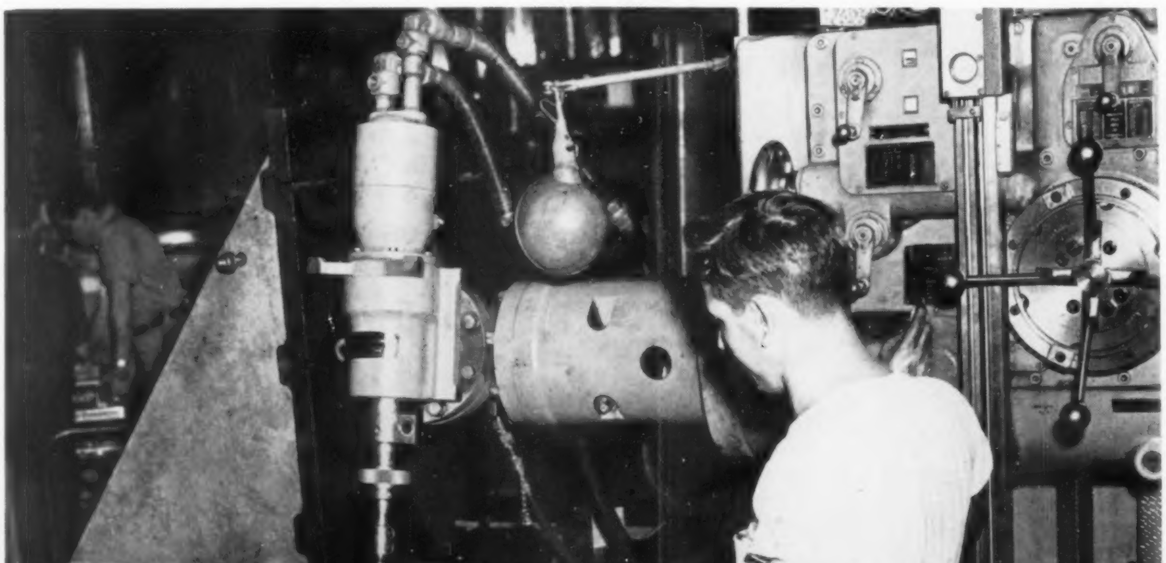


HIGH-SPEED MILLING attachment is mounted on a standard horizontal boring, drilling and milling machine. The attachment is independently driven by a 10-hp motor and hydraulic pump, and is not affected by inertia characteristics of the basic machine drive. The main machine spindle is retracted out of the way when the attachment is mounted. The attachment bolts to the spindle carrier and is vertically positioned by moving the carrier.

Designed for high-speed milling of aluminum alloy forgings for airplane wing hinges, this attachment mounts on the spindle carrier of a standard G & L machine. Called the Full Swivel Hydro-Drive milling attachment, this unit was built by Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., for Grumman Aircraft Engineering Corp., Bethpage, L. I., N. Y.

The attachment will swivel through 360 deg horizontally and vertically, and has a retractable spindle providing easy cutter location on tough machining problems. Speed control is obtained by a throttle lever on top of the variable-volume hydraulic pump that powers the hydraulic motor in the attachment. Spindle speeds can be varied from 800 to 2400 rpm. Overload protection for the cutter and motor is provided in the design.

AIRPLANE WING HINGES have many varying angles that can be easily machined with this milling attachment. The attachment is quickly mounted or removed with a special lifting device and quick-disconnect fittings on the hydraulic hoses. Setup time is about an hour. The spindle nose has a 1-inch diameter socket for holding end mills. Without provision for manual or power feed, the attachment has 6 inches of hand quill adjustment.



INDEXING FIXTURE

raises brazing rate

By Herbert Chase

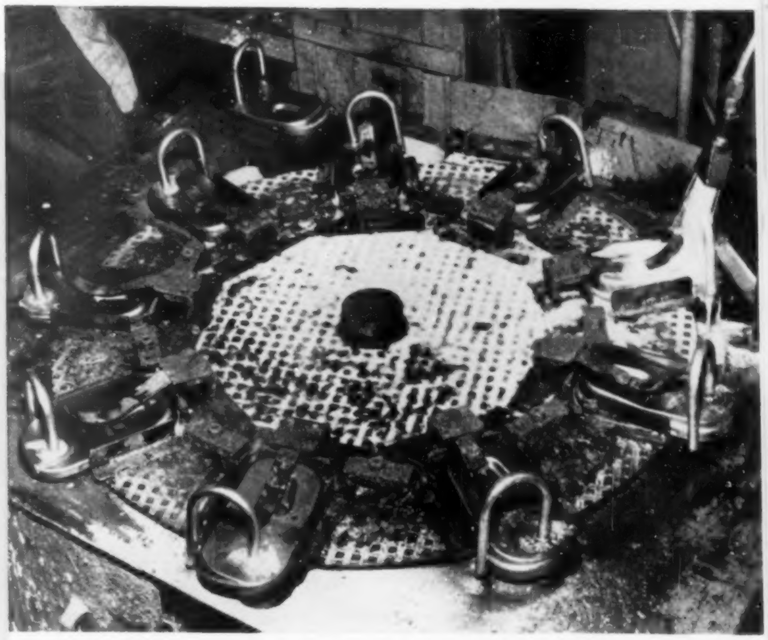


Fig. 1. Two stations in foreground of this indexing brazing machine heat the assembly in two steps. Coolant in background cools the part and flushes spent flux.

Because production brazing rates had to be raised quickly, engineers at Buick Motor Div., General Motors Corp., Flint, Mich., designed and had constructed a special indexing machine which also lowers the cost per piece. This equipment is used to join a U-shaped steel tube to an oil pump filter cover at the point where the tube passes through a hole pierced in the stamping. A single operator can achieve a production rate of 300 silver brazes per hour.

Major component of the machine is an indexing table with nine stations. Each station comprises a recess into which about two-thirds of the stamping fits and a leaf spring which holds the stamping in position. The assembled tube and stamping overhang the table so they are exposed to the direct heat from gas burners at two stations, *Fig.* 1.

The operator slips a ring of Easyflo silver brazing alloy over one end of the tube, inserts this end in the stamping hole, applies a small amount of Handy Flux with a brush and places the assembly in one of the station recesses.

At its hub, the indexing table fits over a pivot pin and rests near its outside diameter on three rollers, *Fig.* 2. Each time the air plunger is advanced, it swings a radial arm through a 40-deg arc. A pivoted pawl under the arm engages a wheel having nine equally spaced projections on its rim. This pawl contacts one projection on its forward motion, pushing the wheel ahead 40 deg, but rides over the projection on the return stroke. A friction shoe acts as a brake to hold the wheel during its dwell.

Near the completion of the advance stroke, the outer portion of the arm slips under the free end of a rocking lever pressed downward by a compression spring located at its other end. This lever decelerates the advance of the arm just before it reaches a positive stop. The air-operated arm rides free on the pivot shaft but both the wheel and the table hub are pinned to this shaft. The table is therefore indexed one station each time the arm advances the wheel.

Located beyond the table are two flame-retention type gas burners. These burners are at the same radial distance from the dial pivot as are the tube holes in the assemblies to be brazed. During the dwell, a workpiece is heated and the brazing alloy melts and runs into the joint. By using two burner stations, the indexing period is shorter than would be required if all heating occurred at one station. Higher production rates are thus possible.

Indexing subsequent to the heating step brings each brazed assembly under a continuous stream of

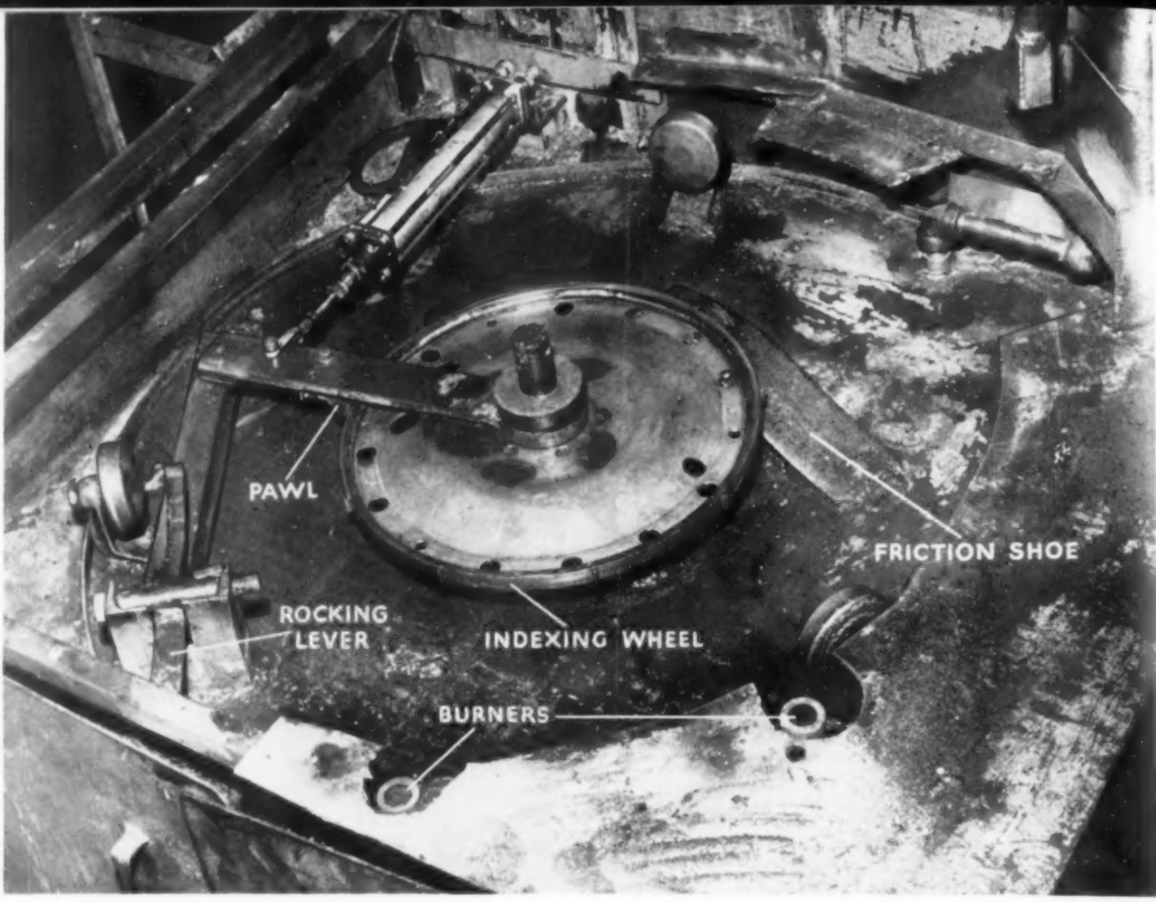


Fig. 2. (above) Ratchet-like indexing device powered by air cylinder turns the indexing wheel. This wheel and the indexing table, which is supported at its outer periphery by three rollers, are pinned to the pivot shaft and move together.

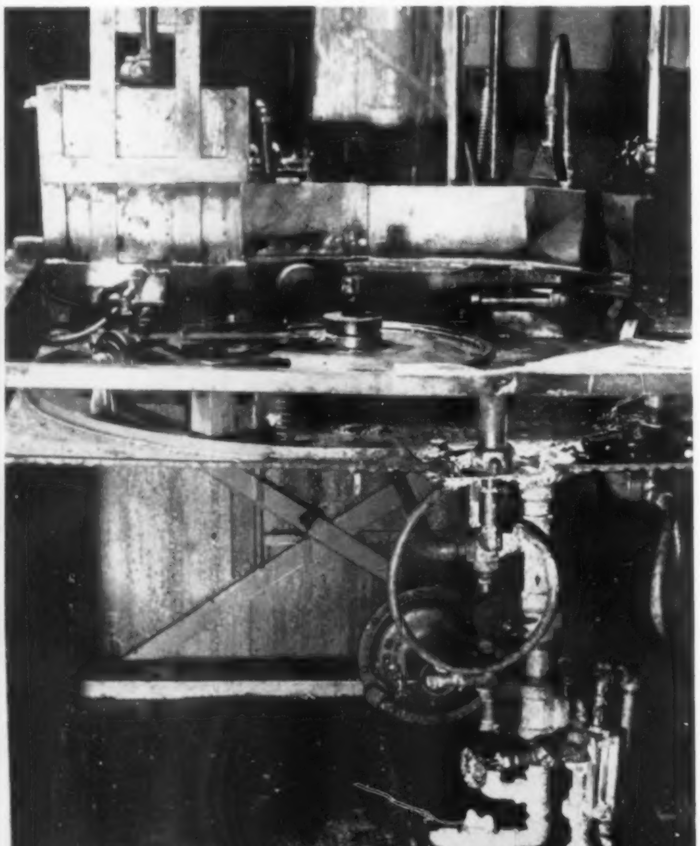


Fig. 3. In the base of the unit are the burner bodies, air and gas regulators and reducing valves, and a pan to catch the coolant.

soluble oil that cools the assembly and washes away the spent flux. When assemblies arrive at the unloading station they are ready to be removed. Indexing occurs each 12 sec and one piece is completed at each indexing.

This is a faster rate than that achieved with the induction heating setup formerly used and, since only one man is needed as against two for the earlier setup, the cost per piece is lower. The total fuel, air, pumping, soluble oil and other costs of operating the new setup (excluding labor) are less than the cost of the water used in the cooling coils of the previous setup. Since the machine was produced in the shop, equipment costs were low.

Natural gas and air for the burners are supplied through reducing valves and regulators from shop lines and burners are adjusted to supply just the right heat in two steps without overheating the parts. With a 12-sec indexing period, the operator has ample time to prepare and flux each assembly, remove one already brazed and cooled, and replace it with the new one. Coolant is circulated by a small pump and drains into a pan in the base of the unit, *Fig.* 3, from where it is returned to a coolant tank. A timer controls solenoid air valves that cycle the air cylinder.

graphitic tool steels

in the press room

By Lester F. Spencer

Consultant Metallurgist
Washington, D. C.

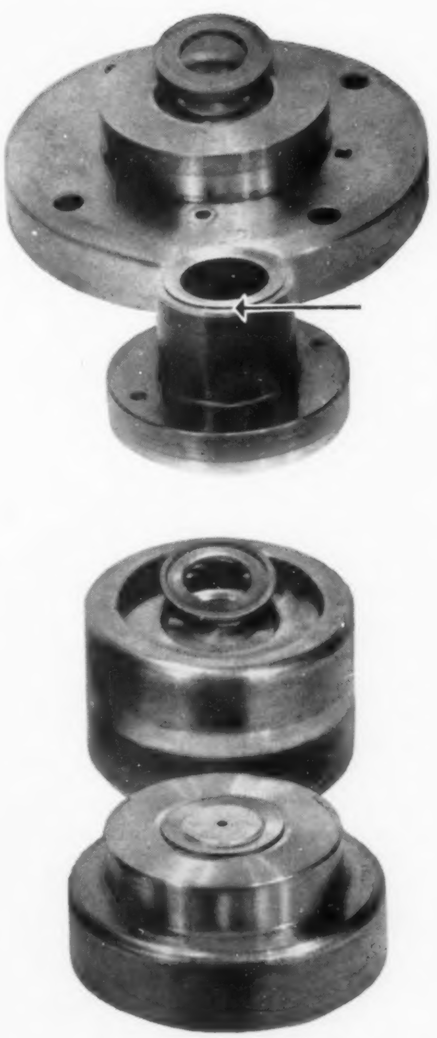


Fig. 1. Graphitic tool steel punch set resulted in 2000 percent better performance than was possible with the ordinary oil-hardening die steel tools they replaced. The former tools chipped at the point indicated by the arrow.
—Photo courtesy Timken Roller Bearing Co.

REGARDLESS OF COMPOSITION, performance of tool steels is judged by the number of pieces blanked per regrind, *Fig.* 1, number of drawn shells or any other quantity item of measurement. Performance is based upon specific characteristics of tool steel composition such as hardenability, resistance to both abrasion and wear, toughness, ease of hardening without undue distortion, etc. Due to the high cost of labor, the factor of workability is becoming of greater importance and should also be considered during the selection of a tool steel. Time required to produce a die represents a large portion of its cost.

A variety of tool steel compositions is available for blanking, forming, stamping and similar cold press work activity. They range from low-alloy steels containing less than 2 percent total alloying elements to high-alloy compositions, such as the high-carbon high-chromium steels. This latter type has approximately 12-percent chromium.

Due to the wide variance in chemical composition of those die steels that are used in the pressroom, basic characteristics and ease of processing vary considerably. As the carbon or the total alloying elements increase in the base composition, the desirable characteristics increase; this is particularly true where carbide forming elements are in the base analysis. However, as performance increases, machinability and grindability usually decrease.

It has been stated[1] that graphitic tool steels are different because the graphite, which is in the base analysis, improves machinability without impairing desirable characteristics of performance. This class of material, which is a relatively new addition to the tool steel family, is characterized by the presence of free graphite. When graphitization is precisely controlled, the compositions: (1) have free machinability in the annealed state, (2) have high resistance to wearing after the recommended quench and temper treatment and (3) exhibit good antifrictional properties with less tendency toward

1. References are tabulated at end of article.

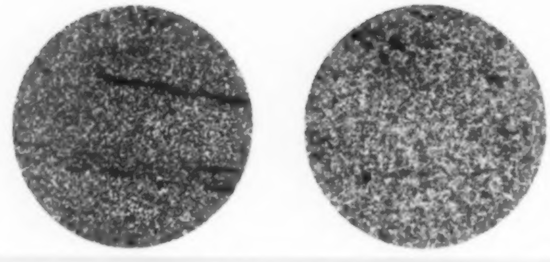


Fig. 2. Structure of type 1 graphitic tool steel in the annealed condition (left) and after it has been oil-quenched from 1475 F and tempered at 300 F. Magnification: 100 X.

pick-up and scoring than experienced with comparable tool steels of similar composition.

As indicated in TABLE 1, which tabulates the chemical compositions of various grades of graphitic tool steels commercially available, these alloys contain both high carbon and silicon contents; the latter element serving as the graphitizer. The proportions of silicon and carbon in the base analysis are of extreme importance. If the silicon content is too low, a weak graphitization occurs. The degree of graphitization is even less[2] in the presence of manganese, chromium or other carbide forming elements.

When the percentage of silicon is too high, graphitization may proceed too far. This condition is indicated by low "as quenched" hardness caused by numerous graphite pockets that fail to properly support the indentor of a hardness tester. As is indicated in TABLE 1, this grade of material can have various combinations of alloying elements, additions being made to change the hardening characteristics.

Because of precise control of graphitization, the tabulated graphitic steels respond successfully to standard procedures for heating and quenching. This control is established by proper adjustment of chemical constituents and by precision production methods. The degree of graphitization is checked before any material is released by the producer.

Each tool steel grade has a specific field of application. The grade represented by type 5 is either an oil or air-hardening steel especially suited for the manufacture of nonuniform dies or parts with small cross sections and comparatively long lengths. Type 4 is a water or brine-hardening material and used on applications that require shallow hardening properties. It is suited for tools that are subjected to considerable impact. The steel containing tungsten, type 3, is also either water or brine-hardening, being recommended for the most extreme abrasive action. However, the most frequently used compositions for pressroom applications are types 1 and 2. The essential difference between these types is the manganese content. Where the cross section of the bar is less than 4½ inches, manganese content is approximately 0.40 percent and type 1 is used. If the diameter of the bar or billet is greater than 4½ inches, the manganese content is about 0.90 percent and type 2 is used.

When comparing performances of a graphitic steel and a standard oil-hardening nondeforming type, it should be remembered that materials such as types 1 and 2 act as low-alloy oil-hardening metals. Results have been reported[3] of galling tests between graphitic and regular oil-hardening die steels. Analysis of the latter material was: 0.92 carbon, 1.11 manganese, 0.46 chromium, 0.09 nickel, 0.02 molybdenum, 0.20 vanadium and 0.61 percent tungsten.

Graphitic steels are most easily machined[1] when they have a spheroidal annealed structure, *Fig.* 2. As indicated by this photomicrograph, the graphite tends to elongate in the direction of rolling, which accounts for the minute streaks and characteristic gray appearance on the surface of a freshly machined bar of graphitic steel. This graphitic streaking persists, to some extent, after the material has been hardened and tempered.

Interesting data has been obtained and published[1] on machinability of graphitic steels. The tests were devised to show relationships between total

Table 1—Chemical Compositions of Graphitic Tool Steels

	Chemical Limits, percent							
Type*	Carbon	Manganese	Silicon	Chromium	Nickel	Molybdenum	Tungsten	Aluminum
1	1.25/1.55	0.35/0.60	0.80/1.10	0.25 Max.	0.25 Max.	0.20/0.30	....	....
2	1.35/1.55	0.75/1.00	0.85/1.20	0.25 Max.	0.25 Max.	0.20/0.30	....	....
3	1.45/1.60	0.35/0.50	0.55/0.85	0.25 Max.	0.25 Max.	0.40/0.60	2.50/3.25	....
4	1.45/1.60	0.20/0.40	0.15/0.30	0.25 Max.	0.25 Max.	....	....	0.10/0.20
5	1.45/1.60	1.00/1.40	0.90/1.30	0.40/0.60	1.65/2.00	0.40/0.60	....	....

*The following trade names have been given to the above types: type 1, Graph-Mo (Low Mn); type 2, Graph-Mo (High Mn); type 3, Graph-Tung; type 4, Graph-Al, and type 5, Graph M.N.S.

Note: Maximum percentage of both sulfur and phosphorous is 0.025 for all types.

tool force, thrust or energy required and the percentage of graphitic carbon within the material. Least tool force or energy is required at relatively low percentages of graphitic carbon, about 0.2 percent. Increase of graphitic carbon beyond that percentage shows a slight decrease in energy required. This relationship, for both milling and turning operations, is illustrated in *Figs.* 3 and 4.

At low surface speeds, the chips from graphitic steels are small and broken. As speed is increased to 400 sfpm, the chip has a tendency to coil tightly, exhibiting a light temper color. By comparing chip colors, it has been found that tool tip temperatures are less when cutting graphitic steels than when standard oil-hardening tool steels are worked.

Resistance to abrasion is one of the more important factors required in many tool and die applications. Many attempts have been made to evaluate this property, but tests of this nature are only of value when they simulate actual service conditions. There are, however, certain factors that are indicative of the general abrasive resistance of any specific material. Hardness and the carbon content of the composition are two such factors. Wear resistance improves with an increase in either the carbon content or the hardness obtained by the customary heat and quench.

Carbon content of the graphitic steels is normally higher than that in standard oil-hardening steels. Even though some of this carbon is eventually graphitized, sufficient carbon is present in the combined form to assure the formation of a hard martensitic structure upon heat treatment. In addition, the graphitic particles, which are finely dispersed throughout the structure, add properties that are directly related to wear resistance.

Laboratory galling tests, performed on an Amsler wear testing machine simulating forming die conditions, has indicated[3] that graphitic tool steels require twice the load to gall or seize as a normal oil-hardening steel. Experimentation into the static coefficient of friction, which compared various grades of graphitic and oil-hardening compositions, indicated that the graphitic steels decreased by one-third the static coefficient of starting friction. These experimental data have been proved under actual service conditions. A graphitic sizing die, after sizing 50,000 pieces, is still serviceable, whereas a standard oil-hardening tool steel, after sizing 10,000 pieces, is in relatively poor condition.

The exact mechanism whereby the graphite particles tend to improve the abrasion resistance of the material is not known exactly, however, it has been theorized that this property may be associated with one or more of the following factors: (a) the graphite particles serve as a lubricant to mitigate initial scuffing, (2) the graphite particles act as tiny reservoirs to retain externally applied lubricant even under high pressure, (c) the graphite pockets hold minute dislodged particles or other contaminants which may be externally introduced and (d) the hard peaks of carbide interspersed between graphite pockets serve as minute bearings.

As with most tool steels, the graphitic tool steels are usually obtained in the fully annealed condition so that subsequent operations of machining and heat treating can be performed. If a considerable amount of machining must be done to obtain the finished die form, it is advisable to interspace a stress relief between rough and finish machining operations. The temperature for stress relief is between 1150 and 1250 F, after which the piece is allowed to cool in air. After stress relief, machining should be done in light cuts to prevent inducing new stresses.

If a fully annealed structure is desired, the graphitic tool steel is heated from 1430 to 1500 F, depending on the specific composition. This treatment is followed by a slow cool in the furnace to a predetermined temperature of 1000 to 1150 F after which it can be air cooled. An annealing treatment such as this will result in maximum softness and from 0.10 to 0.40-percent graphitic carbon, depending on the specific analysis. As indicated in Table 2, types 1 and 2 will have a maximum of 0.40-percent graphitic carbon within the structure, type 4 has the least graphitic carbon.

The importance of relieving internal stresses prior to hardening cannot be overemphasized. Unless these stresses are removed, they may cause warpage or even cracking of the die component when it is hardened. When warpage takes place, there is a change in shape with no change in the volume of the section. Warpage can also occur

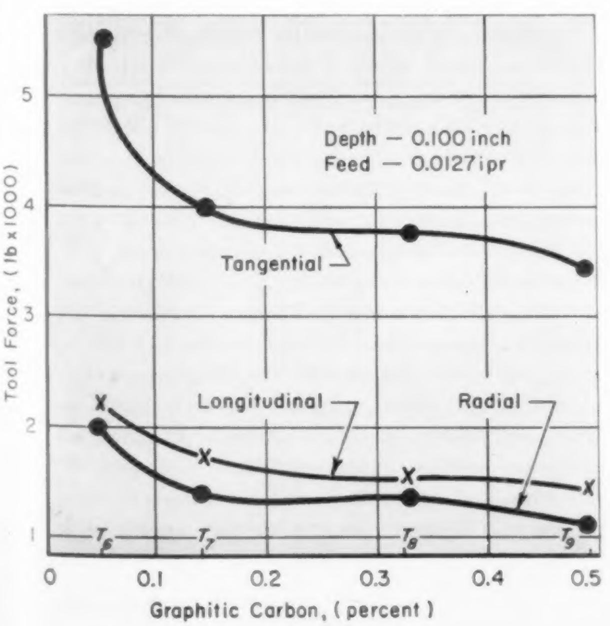


Fig. 3. Effect of graphitic carbon on lathe tool forces.[1]

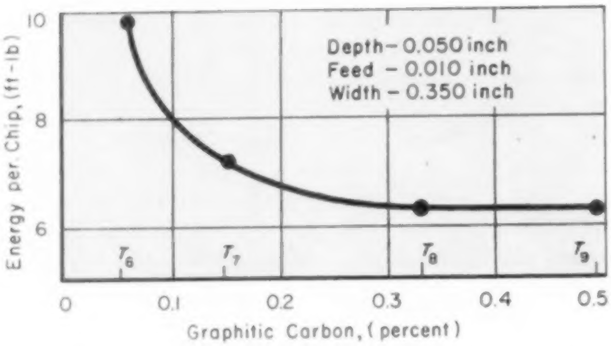


Fig. 4. Effect of graphitic carbon on energy required for milling.[1]

when heating and cooling are not uniform. Such warpage is usually independent of the composition.

The change in volume, which may take place during a heat and quench procedure, is often termed the inherent distortion factor. This volumetric change results from the transformation that occurs during the hardening operation. Graphitic steel types 1 and 2 have good nondeforming properties and maintain accuracy during hardening. Changes in dimensions should be no more than 0.004 inch per inch.

In the selection of a hardening temperature, both the section thickness and the die design should be considered. A higher hardening temperature is required for heavy sections. Considering types 1 and 2, as an example, section thicknesses up to ½ inch require a hardening temperature of 1450 F. Where the die section is within the thickness range of ½ to 2 inches, a hardening temperature of 1475 F is suggested. Where the die section thickness exceeds 2 inches, a hardening temperature of 1500 F should be used.

Die design is quite important when selecting hardening temperatures. If the die is composed of heavy and light sections, it is advisable to use the lowest temperature that will result in the desired hardness; this is especially true where the sections adjoin. Except for massive dies or sections that are extremely complicated in design, a preheat is not usually required. When this operation is mandatory, however, a preheat temperature of about 1300 F is suggested. If the section to be hardened is long and slender, it may require support within the furnace to prevent sagging. The section should be soaked for sufficient time to obtain a uniform temperature throughout the entire section. The temperature of the furnace should not be raised above the recommended hardening temperature to save time.

Decarburization may occur on graphitic steels during any heating cycle whether it be a full anneal or a hardening operation. This decarburization occurs because of oxidation that is experienced at the elevated temperatures. This soft skin is not due

Table 2—Heat Treatment of the Graphite Tool Steels

Factor	Types 1 & 2	Type 3	Type 4	Type 5
Normalizing temp., F	1600	1700	1700	1700
Type of cooling	Air	Air	Air	Air
Annealing temp., F	1450	1430	1450	1500
Type of cooling[a]	Furnace	Furnace	Furnace	Furnace
Hardness after annealing, Brinell	217	262	217	269
Graphite after annealing,[b] %	0.40	0.20	0.10	0.30
Hardening temp.,[c] F	1450/1500	1450/1500	1450/1500	1450/1550
Type of quench	Oil	Brine or Water		Air or Oil
Hardness after quenching, Rockwell	C65/C66	[d]	C67/C68	C63 (Air)

(a) Types 1, 2 and 3, cool 20 deg Fahr per hour to 1100 F; type 5, cool 10 to 20 deg Fahr per hour to 1000 F, and type 4, cool 20 deg Fahr per hour to 1150 F. Air cool permissible after the stated temperature is reached.

(b) Nominal expectancy.

(c) Hardening temperature varies with section size; the higher temperatures used on the heavier sections. Temper to desired hardness.

(d) Brine or water-hardened sections will have a Rockwell hardness of C68/C69. Sections under ½ inch can be oil quenched, however nominal Rockwell values will be about 5 points lower.

to any sensitive element within the base analysis as is the case with some of the high-speed steels. To minimize grinding of the heat-treated die, decarburization can be held to a minimum by coating the surface of the die with a 7-percent boric acid solution using water as the solvent. The same result can be accomplished by packing the die in either a nonburning compound or in cast-iron chips. This practice leaves the part with a smooth, clean surface and, in most instances, all that is required for finishing is a polishing operation. Where controlled atmosphere furnaces or salt baths can be used, these precautions are unnecessary.

If it is necessary to plug holes within the die prior to hardening, steel wool is preferred over either clay or asbestos. The latter two materials act as insulators and can cause hot spots during the quenching procedure. This often results in breaking the die.

Graphitic steels types 1 and 2 are the most frequently used analyses for pressroom tools and dies. These materials are essentially oil-hardening steels. When quenching heavy, solid sections, good agitation of the quenching medium is necessary to permit the die to cool quickly and uniformly to obtain the required martensite for hardness. This is also true when the die has hollow sections. When the medium cannot be agitated, it may be necessary to move the die through the oil to provide some circulation.

Jominy hardness curves, *Fig.* 5, indicate close correlation between low and high manganese types (graphitic types 1 and 2); heavier sections having a slightly lower hardness. The hardness values plotted in the curves represent transverse hardness.

As with other types of tool steels, a tempering operation follows hardening. This treatment relieves residual stresses and produces a die with some toughness. The temperature of this operation is

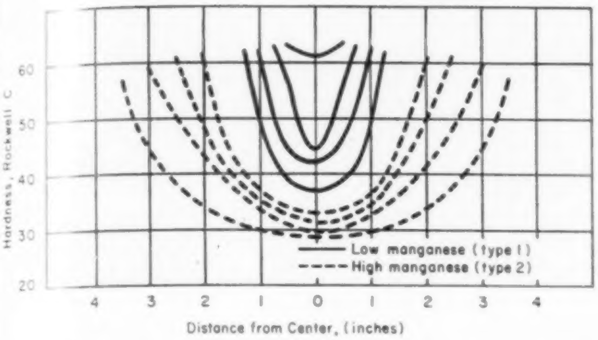


Fig. 5. **Hardness penetration curves for oil-quenched round bars of types 1 and 2 graphitic tool steel. Bars were tempered at 300 F.**

dependent on the specific application for which the die is intended and ranges from 300 to 350 F. The relationships between tempering temperatures, and hardness and impact values are given in TABLE 3.

When it is necessary to stabilize types 1 and 2 graphitic steels, such as would be the case for a gage master or other measuring reference, the procedure involved after hardening is quite different than that normally followed. In this instance, it is necessary to obtain full transformation within the section so the gage will remain constant.

Stabilization consists of tempering at 300 F for a period of approximately 4 hours, after which the

Table 3—Relation of Hardness and Impact Values to Tempering Temperatures

Tempering Temperature (F)	Hardness (Rockwell C)	Impact Values (ft-lb)
300	64	19
400	63	23
500	61	22
600	58	28
700	53	41
800	50	58
900	46	75
1000	40	94
1100	36	113
1200	26	120

Material oil-quenched from 1450 F. Unnotched Izod test bars employed.[1]

part is cooled in air. Further transformation is promoted by placing the part in a deep freeze where it is held for a predetermined time at —120 F. It is then removed and, after the section has again reached room temperature, it is retempered at 300 F for another 4-hour period. The complete cycle is repeated for further stabilization.

If a die must be ground to finish size, it is essential that all residual strain introduced by quench hardening be removed by a tempering operation. In order to obtain proper guidance as to depth of cut, speed and feed, in addition to the proper choice of wheel, it is advisable to consult a grinding wheel supplier. Grinding is important and if either an excessive cut is made or an improperly dressed wheel is used, failure may result in service. However, it has been recommended that the following wheel types serve adequately, especially when grinding wet:

(a) Types 38A602-I8VBE, 32A602-J8VBE or 9A603-J2-VOS for cylindrical grinding.
(b) Types 32A602-J8VBE, 32A602-J5VBE or 9A604-K2-VOS for internal grinding.
(c) Types 32A602-F12VBEF or 9A603-G3-VOS for surface grinding.
(d) Type A100-Q9BH for general-purpose thread grinding and type 38A150-K8VBE when extreme accuracy is required in thread grinding (graphitic steels types 1 and 2 only).

When a graphitic steel die must be reworked after it has been hardened, reheating to about 1300 F will soften the die sufficiently. This temperature is below the critical point for most graphitic steels and the percentage of graphite within the composition will remain undisturbed. Type 5 graphitic steels should be reheated to only 1200 F.

Types 1 and 2 are the most frequently used graphitic steels in pressroom work. Typical uses include: blanking dies and punches; drawing and forming dies for large parts and heavy gages of sheet and strip; dies for blanking, piercing, perforating and forming rubber; dies for cold trimming and slitting, and plug gages.

Type 2 graphitic blanking and scoring punches, *Fig.* 1, produce 10,000 to 15,000 bearing races per regrind compared to an average production of 500 in the ordinary die steel tools they replaced. The first-operation set punches blanks from 1/4-inch cold rolled steel and scores an indentation for locating the piece in the coining die. The second-operation set sizes the outside diameter and finish coins the race. Both sets of tools were heat treated at 1525 F, quenched in oil and given a 700-F draw.

Graphitic tool steels, when compared to conventional oil-hardening steels in the same class, have excellent performance records. The graphitic content within the base analysis provides free machinability in the annealed state and contributes to those properties that are responsible for high performance. Another advantage is that conventional heat treating methods are used.

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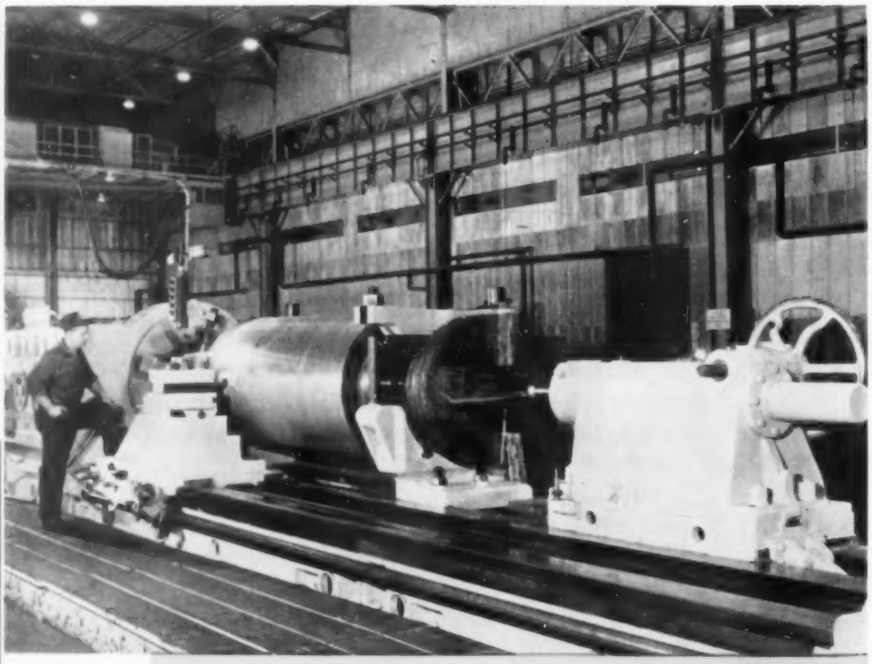
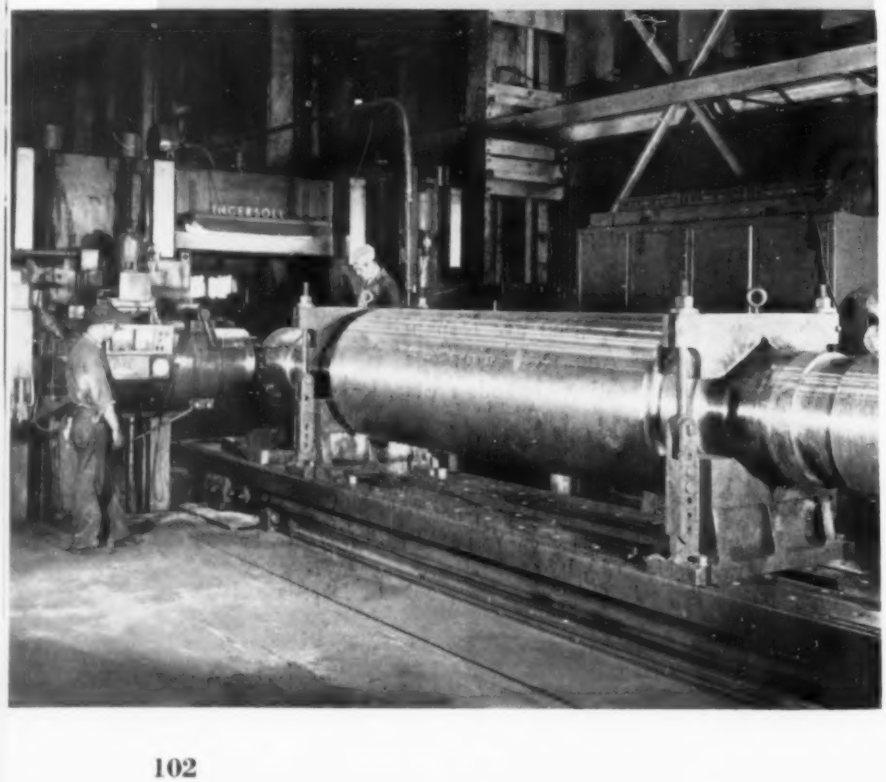
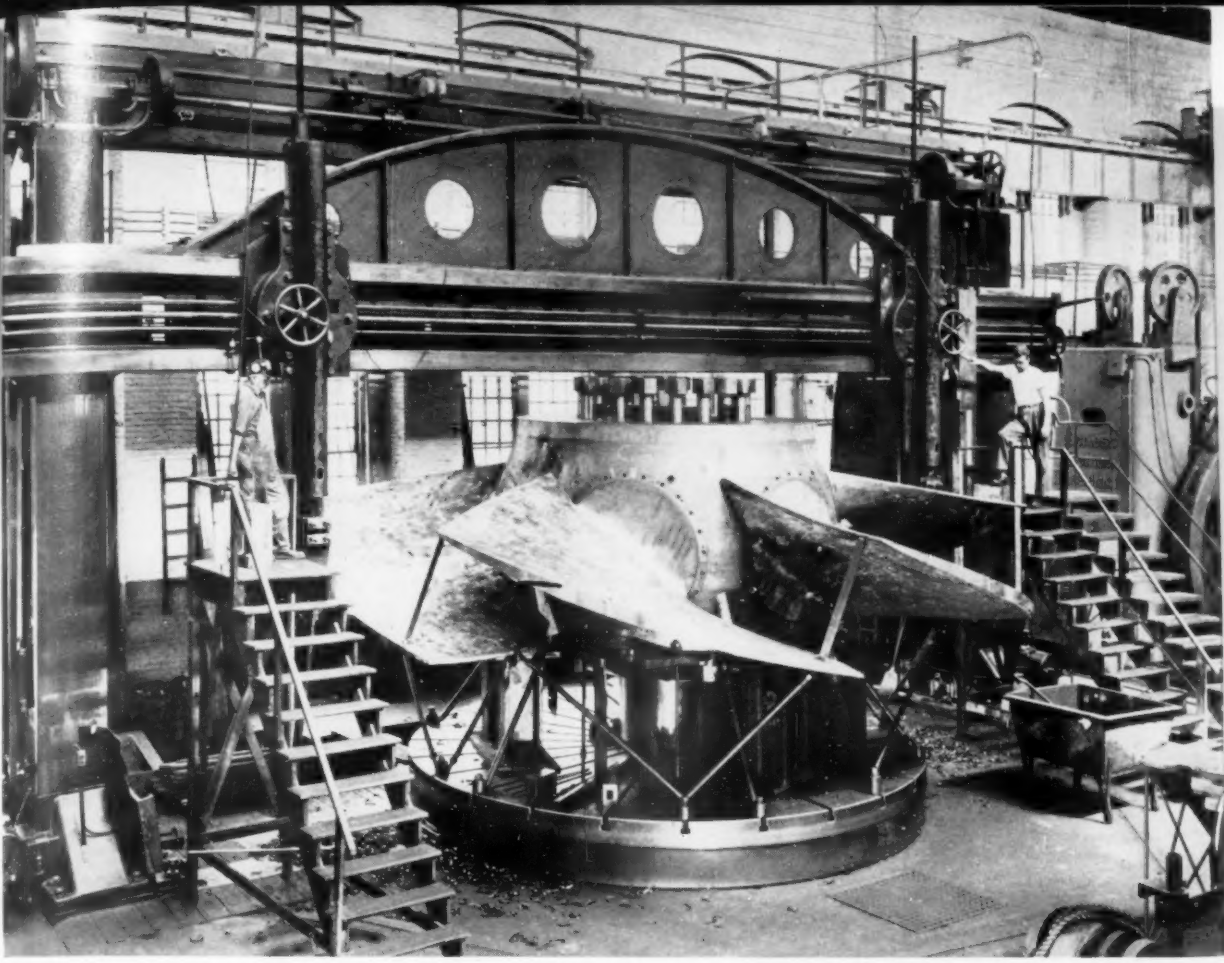
TOOLS at work

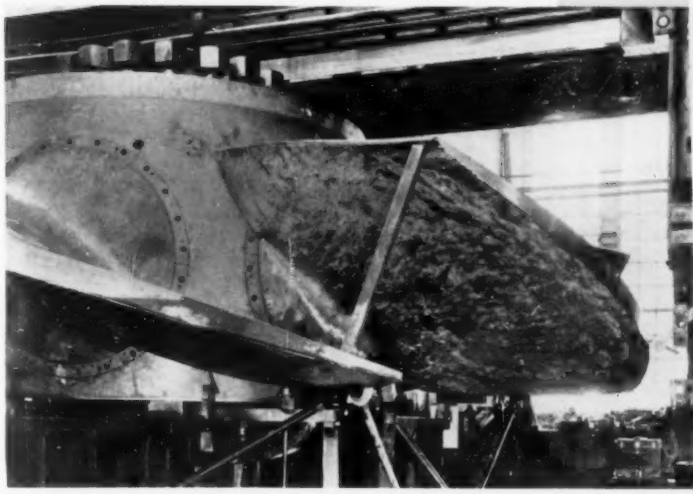


TURNING A 30-TON steel base slabbing mill roll in a 60-inch screw feed lathe in the Fairless Works of U. S. Steel Corp. The workpiece body is 45 inches OD and 90 inches in length, with a scleroscopic hardness of 38 to 40. A cut of $\frac{1}{4}$ inch with a $\frac{3}{32}$-inch lead is set to redress the surface in one pass. The roll is supported in neck rests for concentricity of the body with roll necks. The Mackintosh-Hemphill lathe has a maximum distance between centers of 20 feet. Longitudinal and cross feeds are controlled by power-driven feed screws.



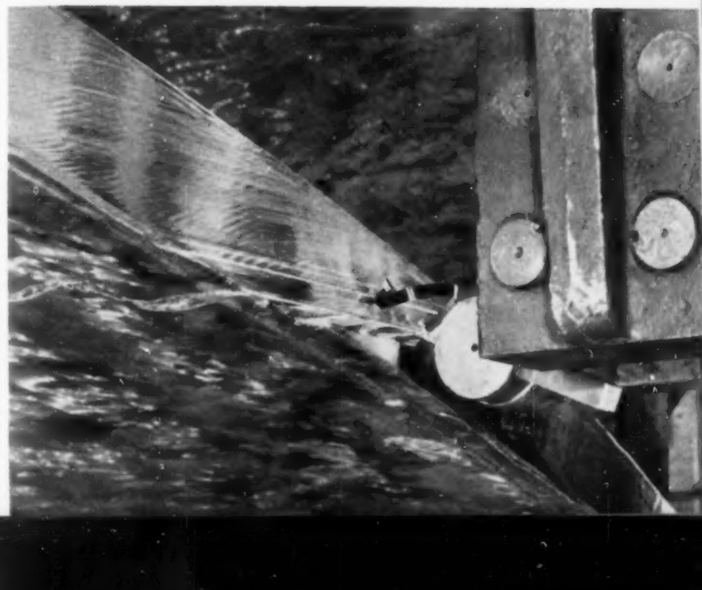
MILLING FLAT COUPLINGS on a cast 36 x 120-inch plate mill roll at Blaw-Know plant in Pittsburgh. With this setup the coupler flats can be produced parallel and centered to the roll axis within the 0.002 inch required for accurate alignment of the high-speed mills. Material hardness is 45 to 65 scleroscopic. The universal milling machine being used has a double-head, 22-inch diameter quill. Machining time is $\frac{1}{4}$ that required by previous methods.





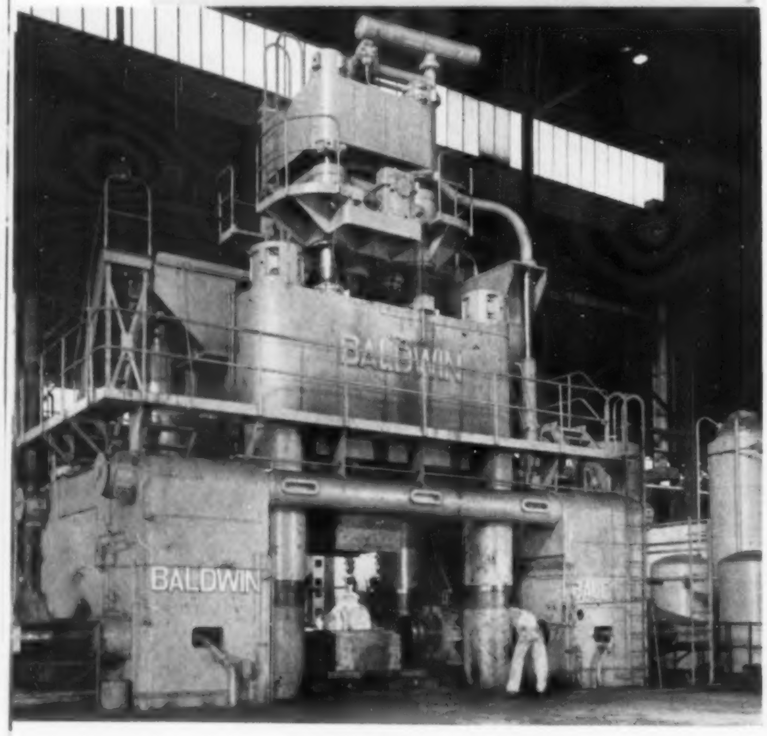
MACHINING BLADE TIP CONTOURS of 165-ton, cast steel propeller runner for McNary Dam turbine at S. Morgan Smith Co., York, Pa. Especially difficult tool engineering problems were involved; tough, irregular work, slight eccentricities in the casting, interrupted cutting and machine rigidity. The large mill used swings a diameter of 35 feet 8 inches. It has cast iron ways and relatively light vertical rams. The turntable was run a 2.1 rpm, giving surface speed of 154 fpm. Operator on right platform follows hardwood template to control horizontal travel of tool and cut proper contour. Operator guides opposite tool by visual estimate of depth of cut.

(Closeups) A carbide tool, standard Carboloy type, was turned on its side and modified to fit the toolholder. The 7-deg side relief became a 7-deg positive side rake and the 15-deg side cutting edge became a 15-deg negative back rake. Wavy-line effect is produced by impact and vibration of tool post. Second roughing cut is being taken. Three passes were required. Width of cut was determined by mathematical requirements for blade contours and the adjustable pitch blades were set at 16.5 deg from zero position throughout the operation.



TOOLS at work

SPLIT DIE FORGING OPERATION at Cameron Iron Works, Houston, Texas, involves a 3590-lb workpiece of steel which is forged in several steps. After completion of the first strike the part is being removed by the mechanical manipulator for reheating. Subsequent operation is shown below.



SPLIT DIE FORGING PRESS, largest of its type, pierces the throttle valve body with two side acting rams and an auxiliary down acting ram in a further operation. Total force exerted by main ram is 11,000 tons, with 6000 tons each possible on the two side rams. The complicated part is produced without draft by means of the multiple rams and split dies.

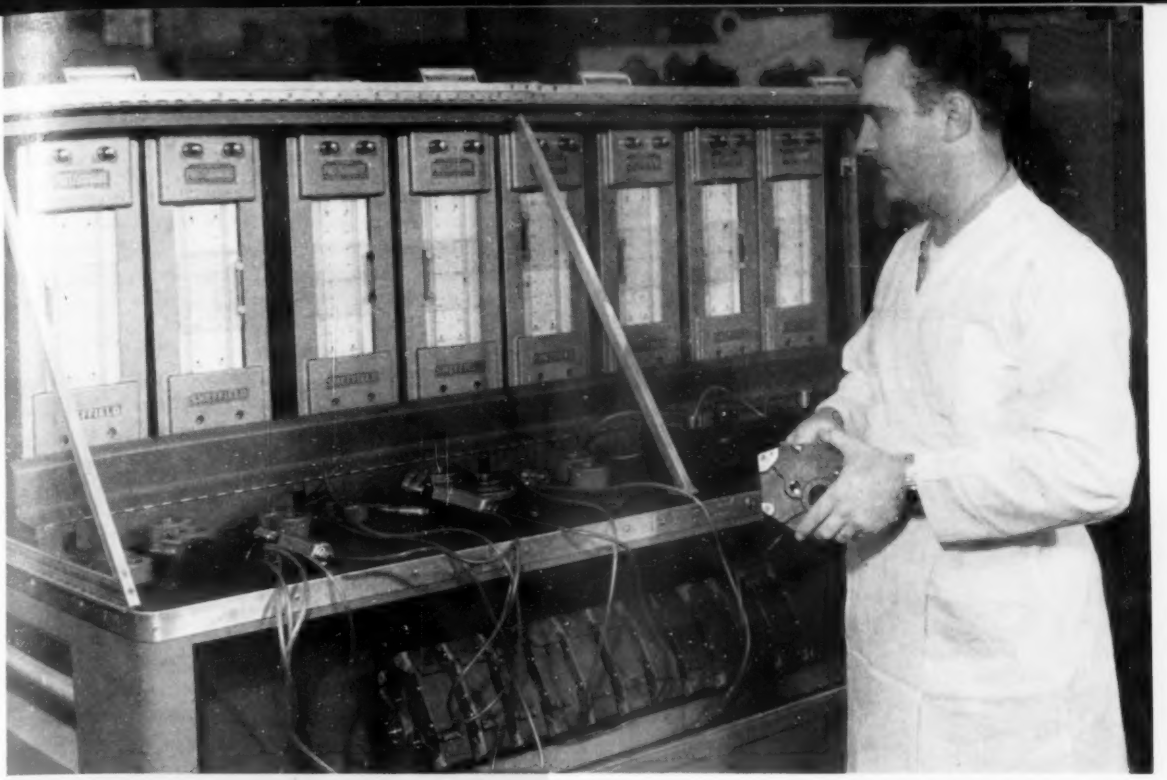


Fig. 1. Inspector checking a part taken from a pilot run. Inspection is made by variables with an air gage to secure data to determine machine capability.

Machine Capability Studies

improve production efficiency

By Martin H. Saltz

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Hughes Aircraft Co.
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Too frequently, in practice, jobs are assigned without consideration of the capability of a machine or process. This results in the assignment of jobs with specifications beyond the capability of the machine or process, and inefficient or wasteful operations. Such a situation can occur in machining, heat treating or any other production operations. The quality control techniques described in this article have to the present time found widest application in machining operations where improvement in efficiency has been most evident, *Fig.* 1. For this reason, they will be discussed from that viewpoint, though the same considerations are applicable to other processes where results can be measured.

While a certain amount of variation in a process is unavoidable, due to chance factors, superimposed on this are other causes of variation which can and should be eliminated. Consider first a process that is operating with only chance variations. Parts produced by such a process, if grouped according to a particular measurement, would form a distribution as shown in *Fig.* 2. For most practical situations, especially where production runs are relatively long, it can be assumed that this distribution can be represented by the equation for a normal curve.

For a particular process or operation, if the avoidable causes of error are held to a minimum,

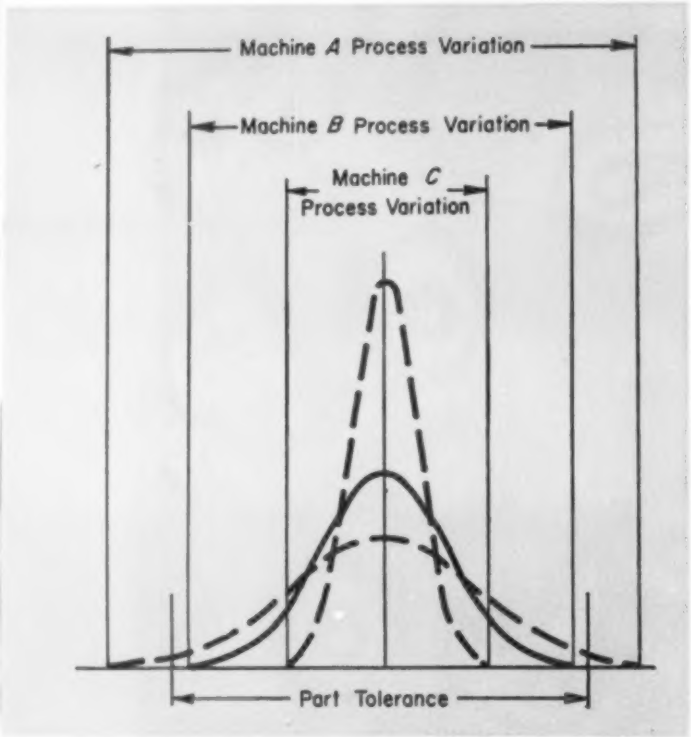


Fig. 2. Distribution of parts according to one dimension, for three different machines. The process variation for machine *A* exceeds the part tolerance; the variation for machine *B* is slightly less than the part tolerance, and the variation for machine C is much less than part tolerance.

then a picture of the ultimate that could be expected from the process would be secured. For machining operations this figure is referred to as the machine capability, and is represented by the spread of the distribution. If the machine capability exceeds the tolerance of a part to be worked on the machine, then it can be assumed that the parts can be produced without too much difficulty. This condition is illustrated by machine *C*, *Fig.* 2. If the machine capability is almost as wide (machine *B*, *Fig.* 2), or wider than the part tolerance (machine *A*, *Fig.* 2), then it is certain that the parts cannot be produced on the machine without rejects which would have to be screened out.

If such information is available on all machines prior to the assignment of jobs to them, then assignments can be made on the basis of capabilities and each job can be produced at the highest efficiency. An approach of this type is especially advantageous in the beginning stages of production where a machine area is being set up and work assigned.

The next question is how such a study should be performed. If a pilot run is being made, then the study can be carried out on these parts. Otherwise, a study can be made of a special run of parts representative of the type of operation that the machine performs in production.

Listed below are the steps necessary to carry out such a study:

1. The part on which the study will be based must be selected. It is important that this part be representative of the operation or process.
2. A data sheet, such as shown in *Fig.* 3 should be provided. This consists of three sections used to:
   A Identify the machine and operation.
   B Plot the data.
   C The necessary calculations.
3. The operator must be instructed to work the part as close as possible to the nominal dimension. (This nominal dimension does not necessarily have to be the nominal dimension of the part. It may for convenience be a particular dimension selected by the operator. It is important in the computation of machine accuracy that the operator understand he is to make every effort to produce the parts as much alike as possible. In effect, he is reducing the natural spread of the process to a minimum.)
4. The heading of the data sheet as shown in *Fig.* 3A should be completed. Information required will vary with the firm and type of company records.
5. Measuring equipment, with the capacity to measure beyond the accuracy of the machine being tested, should be selected and made available.
6. A scale should be established in the data sheet allowing room for plotting all variations expected.
7. As each part is produced by the operator, the inspector should inspect the part and record a cross mark in the appropriate position on the data sheet. This step should be repeated for not less than 50 pieces. For more dependable results 100 pieces should be checked.
8. Based on this data, the machine accuracy is given by 6σ, where sigma is a measure of the process variation.

In order to simplify calculation of 6σ, four decimal places are dropped so that deviations in ten thousandths of an inch become whole numbers. When the technique is new, it might be best to set up the working data as in TABLE 1, using the following headings:

(a) x—the deviation of a part dimension from the nominal value

(b) f—frequency of each measurement

(c) fx

(d) x^2

(e) fx^2

$$\text{The Standard Deviation (sigma)} = \left(\frac{\Sigma\, fx^2}{n} - \bar{x}^2 \right)^{1/2}$$

$$\text{Where } \bar{x} = \frac{\Sigma\, fx}{n}$$

$$n = \Sigma\, f$$

Then the calculation for sigma for the data shown in *Fig.* 3 is as follows:

$$\sigma = (114.84 - 99.60)^{1/2} = 3.904$$

$$6\,\sigma = 23.424$$

Therefore, the machine accuracy is $6\sigma = 0.00234$

The calculations are summarized on the data sheet at C, *Fig.* 3, so that the results will become part of the record. Copies of the study should be distributed to production planning, machine maintenance and other groups that would be interested in this type of information. The time of the study and the results should be put into the appropriate maintenance records so that by repeating the study at periodic intervals changes in machine accuracy would show up as a trend. Such a trend is of value in determining when machines require overhaul and other repair work. When properly utilized, this type of information is invaluable to a program of preventive maintenance.

This data is of value to production planning as indicated earlier, in the assignment of machines, in determining schedules, etc. It must be realized that the value of 6σ as computed is the best work that can be expected of the machine. In production, machine accuracy will be somewhat less. This machine capability value can be used for an estimate of the amount of trouble that can be anticipated in carrying out a particular operation. A comparison of the computed machine accuracy and the part tolerance, as per the drawing, will give an indication of the difficulty that will be experienced. The more latitude between the two, the easier it will be to meet the tolerance and the more rapidly production can be completed.

Such study will cover only one particular operation—cutting speed and stock size for a machine. Actually, machine accuracy does vary with these factors. A machine may be required to handle a large number of different types of material at different cutting speeds; if so, it would be advisable to perform a series of studies in order to establish a range of these figures for different circumstances. Since, in larger shops, machines frequently are assigned to a particular type of work, a single study is usually sufficiently indicative of what can be expected.

In some concerns, instead of performing a study to determine the ultimate that a machine is capable of doing, it is preferable to determine what can be expected from a particular machine and setup under production conditions. This is often referred to as a machine operational accuracy study. The procedure that has been outlined is still applicable, the only difference being that instead of pieces being made as close as possible to a nominal dimension, they are made under production conditions. The firms using this approach feel that such a figure is of more practical value in that it represents what

Fig. 3. Form for machine capability study. Provision is made for identification of the machine, graphical recording of data and necessary calculations. Recorded data are deviations from the nominal value in ten thousandths of an inch. Four decimal places are dropped for convenience.

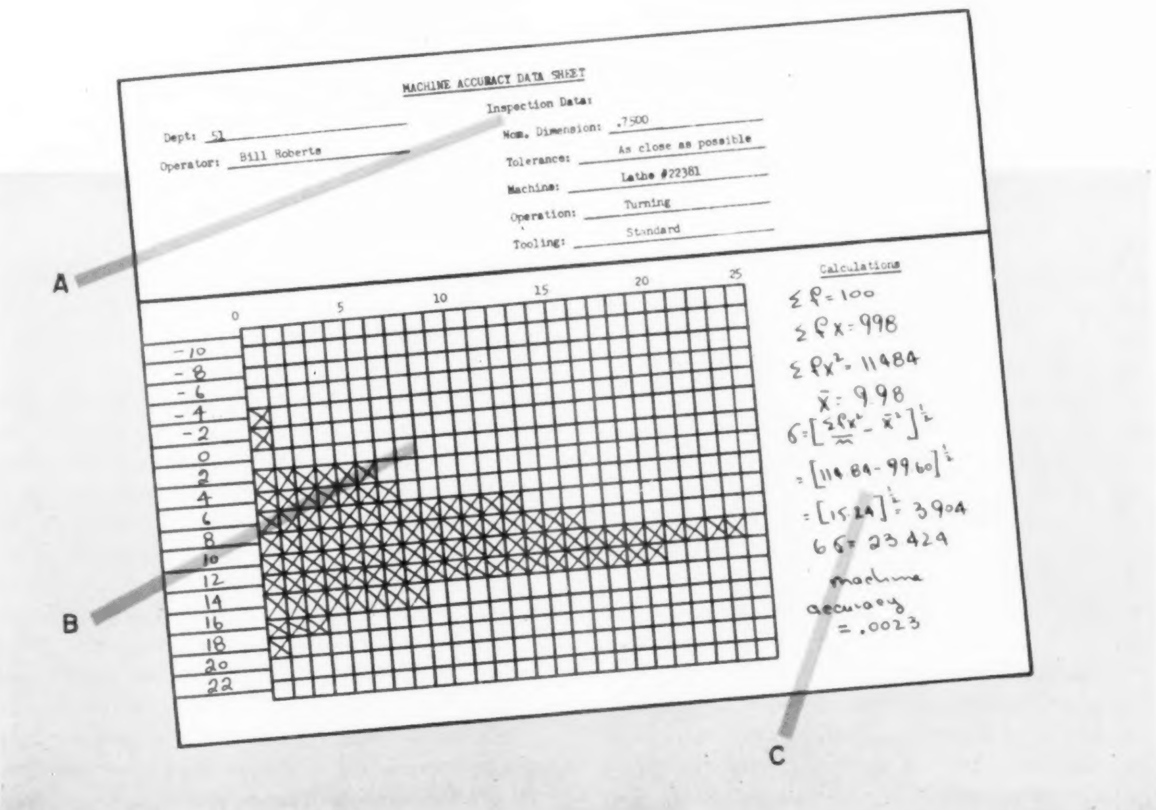


Table 1—Working Data for Calculating Machine Capability

x	f	fx	x^2	fx^2
-3	1	-3	9	9
-1	1	-1	1	1
1	0	0	1	0
3	6	18	9	54
5	7	35	25	175
7	13	91	49	637
9	16	144	81	1296
11	24	264	121	2904
13	20	260	169	3380
15	8	120	225	1800
17	3	51	289	867
19	1	19	361	361
Total	100	998		11,484

can be expected under shop conditions and therefore it is directly applicable to production scheduling, etc. Regardless of the approach taken, the mathematical computations are the same as outlined.

The computations are handled on what is known as a "group data" basis. That is, all of the differential measurements are grouped into subgroups, such as 0-2, 2-4 and 4-6. This technique somewhat simplifies the computations, especially where they have to be repeated frequently. Where group data is awkward and a calculator is used to perform the computations, the data are handled in the original state. When such a technique is used it is referred to as "ungrouped data." To perform these computations for determining machine accuracy based on the ungrouped data approach, the steps are as follows:

1. List all of the measurements in their sequence as taken
2. Sum the data and divide by the number of readings. This gives the arithmetic mean and is designed by $\overline{x}$
3. Square the $\overline{x}$ value calculated in Step 2. The result is $\overline{x}^2$
4. Square the individual readings, take the sum of the squares and divide by the number of readings. This mean value is designated by $\frac{\Sigma x^2}{n}$

Sigma (Standard Deviation) is now given by the equation:

$$\sigma = \left[\frac{\Sigma x^2}{n} - \overline{x}^2 \right]^{1/2}$$

and n is the number of measurements taken. Machine accuracy is still given by 6σ. For the example, these computations result in a value of 3.904; 6σ becomes 23.24, and machine accuracy is then 0.00234 inch. The two values arrived at by these different methods, should be equivalent since, except for the mathematical techniques involved, the technical considerations have been the same.

Improved Plastics by Irradiation

NUCLEAR ENERGY has been utilized to change characteristics of an ordinary plastic and consequently broaden its potential uses. The method, which permits the plastic material to withstand temperatures as high as 350 deg, has been revealed by the American Agile Corp., first company to make products of the substance available for industrial applications.

The material, Agilene-HT, consists of ordinary polyethylene which has been subjected to bombardment of subatomic particles of high energy. This treatment alters the original materials' molecular structure as well as certain of its properties such as heat resistance and tensile strength. To date, this plastic's low resistance to high temperatures has prevented its use—at least its broadened use—in industries where its other characteristics would prove advantageous. The altered substance, may now be used, for example, to make evaporators and containers for boiling solutions; or for food, pharmaceutical or biological equipment which is frequently sterilized.

Irradiation has not only given this plastic better tensile strength and elongation—properties retained at high temperatures—but has increased its solvent resistance and removed the former disadvantage of stress cracking in certain environments. All the usual properties of toughness, flexibility, impact resistance and inertness in most chemical environments appear to be retained regardless of radiation.

The new resistance to heat plus the native dialectric properties of plastics now open infinite possibilities for electrical and chemical industries, and for laboratory use. Since, for practical purposes, manufacturers are dealing with a new substance, fabrication methods must be re-evaluated.

tooling for volume production

how Pontiac retooled its engine plant

By Ralph H. Eshelman
Associate Editor

WHEN PONTIAC'S DESIGN ENGINEERING came up with a brand-new V-8 engine for the 1955 model it posed an unusual opportunity and challenge for production. The opportunity offered was for a sweeping modernization seldom afforded a manufacturing organization. The challenge was to create a plant that would attain the ambitious levels of production and quality set in early planning.

The result is an integrated production line of all new equipment, including 65 tool control boards, 14,200 feet of power-and-free conveyors focusing on the ingenious merry-go-round test area, *Fig.* 1, and a total of over 550 production machines housed in one building. Disregarding one or two exceptions, the entire array of machines has been set up in 1954. In fact, the space was in use in production of the old six and straight-eight engines until November, 1953.

There are many exceptional machining operations in the new plant. For instance, machining of the cylinder block casting, *Fig.* 2, is accomplished on a completely closed line holding 440 units. Some of the highest feed rates are used here of any in the industry. For example, the cylinder banks are face milled at 110 inches per minute. Processed in 170 separate operations, the block must be touched by hand at only two stations. In addition to the block line, the head line, consisting of 100 operations, is

Fig. 1. Assembled engines are brought by power-and-free conveyor to this unusual merry-go-round stand which carries engines around as they are tested. Testing is continuous, being reduced to a production-line basis, with savings in capital expenditure, handling and production time. Accepted engines leave by power-and-free conveyor for installation in car.

completely automated, as are many of the operations on component parts such as crankshaft, camshaft, valves and valve guides, transmission housings, manifolds and connecting rods.

Chip disposal on the plant's major machining lines is automatic to centralized shipping points. The volume carried by the dry chip system is 8 tons per hour in full production. Length of the system is more than 4400 feet. This system is designed so that a final conveyor line can be installed to carry the load to the reprocessing plant.

Automatic gaging and sorting equipment is used throughout the plant, *Fig.* 3, largely replacing hand inspection. This type installation is probably used more extensively here than in any previous engine

Buel E. Starr, general manufacturing manager of Pontiac Motor Division, has an extensive background of automotive engineering and manufacturing experience in various GM divisions. For instance, he worked on design of the old Oakland V-8 engine in 1927, then in engineering-manufacturing liaison after it was put into production. In September, 1937, he became assistant plant superintendent of the motor plant. In February, 1941, he moved over to superintend the Oerlikon plant, Pontiac's first defense project. Later in the war, he went to the Torpedo Plant as plant manager. On May 1, 1944, he was promoted to general superintendent of all plants at Pontiac Motor. In January, 1947, he moved up to his present position.

plant. Thus, in-process or machine-control type gaging is built in many machines.

These are some of the statistics that impress visitors. But the story behind them is one of meticulous study and foresighted planning, of many small and some unusual problems overcome. For example, the master mechanic responsible for much of the early planning, Howard Phelps, died in April of '53. One of GM's outstanding assets, however, is a seemingly exhaustless reservoir of high-caliber management personnel, which has given it the reputation of being a training ground for industrial executives.

While the plant will undoubtedly be tagged with the customary clichés—"pushbutton factory," "robot production" and "the last word in automation"—actually Buel E. Starr, Pontiac's general manufacturing manager and his staff had no such goal in mind. With a solid background of many years in both design and production engineering, this level-headed production executive took the tool engineer's hardheaded, practical approach.

Management's Viewpoint

Specifically the aim was simply to secure proved machines and equipment and weld them into a production unit that would provide the output required with the highest practical quality at the most economic cost. Wherever installed, automation-type equipment was selected only because it could be established in black and white that it would pay for itself in a reasonable time.

The general manufacturing manager, being a good organization man in the GM tradition of cooperation, is the first to point out that many people contributed to the Pontiac achievement. Top tool engineers, such as Thomas E. Seavey, master mechanic; J. F. Kennedy, planning and standards department head, and T. W. Bradford, plant engineering; all had notable roles in setting up the engine line, with the help of such assistants as R. W. VanDinen, asst. master mechanic; Al Host, process engineer; W. H. Kinsley, methods and plant layout; H. H. Wood, time study and cost estimating, and many others.

Responsibilities are functionally divided with close cooperation and liaison maintained among the three groups. The master mechanic's department is responsible for processing and tool design so logically had the basic responsibility for contacts with machine builders and placing orders.

The planning and standards department handles machine efficiency studies and establishes feeds and speeds. In addition the group has charge of time and cost studies, and plant layout. Besides making

recommendations on comparative advantages of equipment and changes to suit or improve plant layout, it had the responsibility of preparing management reports on estimated production costs of proposed setups for producing various parts for the purpose of deciding extent operation should be automated, amortization factors and the like. In the matter of amortization no hard and fast rule was used, because obsolescence for various types of machines and equipment was expected to vary. Thus the power-and-free conveyor system for engine assembly use was set up for a longer period than most items. On the other hand, some units were evaluated at a shorter period because of the probability of short-term changes. In most cases it was assumed that equipment should pay for itself in as short a time as possible, two years being considered a practical period. On the basis of these studies automaticity of operations was chosen either because it appeared competitively advantageous or it was determined that other operations were dependent upon it.

The plant engineering department, having responsibility of physical details such as machine installation and maintenance, chip disposal, light and power, was primarily concerned with the building facilities and location of equipment.

At the outset Pontiac was determined to install nothing but thoroughly tested machines because production of previous engine models was being discontinued with 1955 production. In order to benefit from accumulated experience, numerous visits were made to many other automotive engine plants, especially those which had recently installed automated equipment. The master mechanic early established a requirement that machines should be built exceptionally rugged because in his experience many of the interruptions and

Fig. 2. (below) Milling operation on pan side of cylinder block. Drawing, p. 113, shows layout of line.

Fig. 3. (right) Connecting rod openings and bearing cap installation are checked automatically by gage at right of center. Locating of block by four machined lugs on slide rails is evident, as are locating stop and transfer bar.

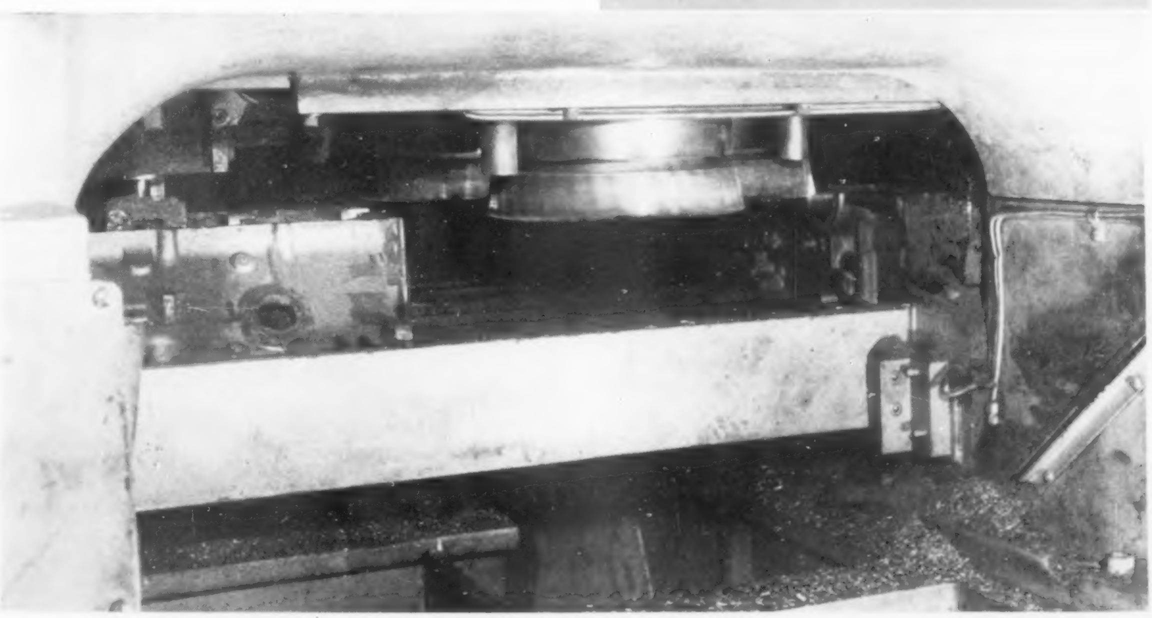


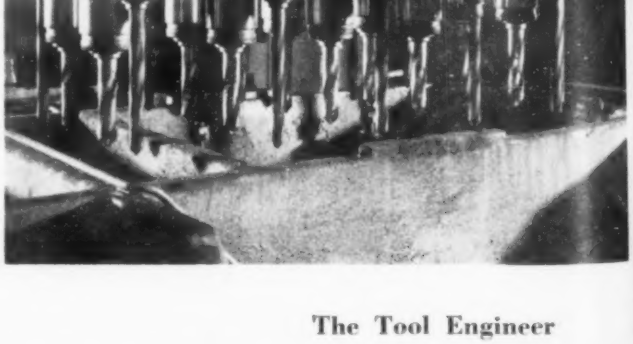
Fig. 4. Loading end of cylinder block line showing castings moving into first milling operation.

troubles arising in continuous production operations could be attributed directly or indirectly to deficiencies in this respect. Other initial considerations were the need for accessibility for maintenance and flexibility to accommodate product changes both of running and new-model types. As is evident from the accompanying plant layout, these two factors were taken into account by setting up vacant stations; i.e., stations without processing operations. These stations were sized to accommodate standard machines so they could be added as required. In this way, provision was made for an estimated 60-percent convertibility in product without major rearrangement of the line. Though the empty stations are bridged with transfer conveyors to make a continuous line, ease of access for maintenance of machining units is achieved. Another purpose is also served. Parts can be removed in processing at many points, facilitating what may be termed segmented automation, a recent GM concept. Thus, a portion of the block line, for instance, can be operated, though another portion is down for maintenance. Lost production can be regained later through overtime operation.

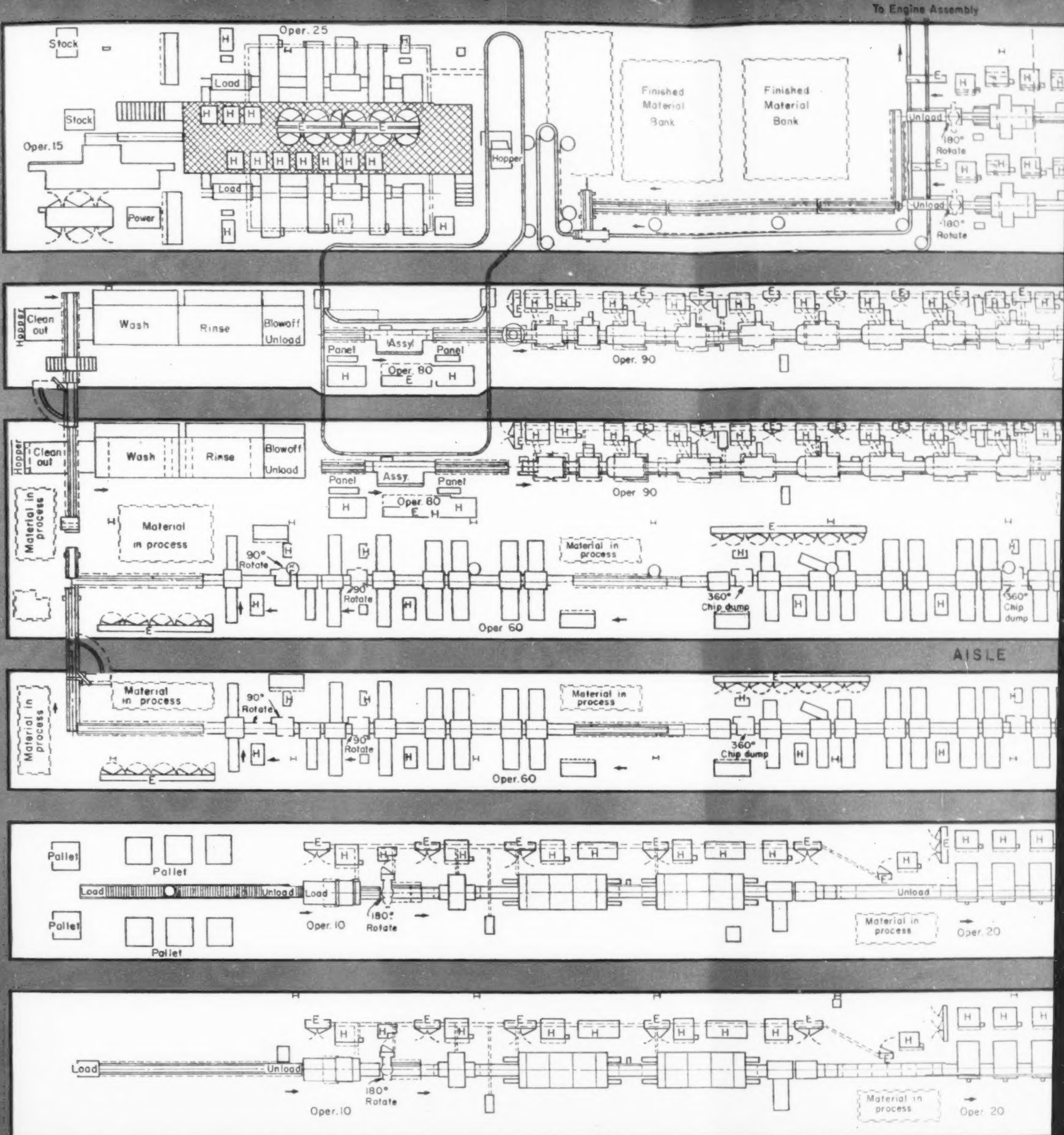
Basic Problems and Policy Decisions

The first step in setting up the new engine production was establishment of the processing group in the master mechanics' department in February of 1952, though the standards department had already engaged in some forward planning. The second step was to determine equipment required based on preliminary process sheets. Innumerable discussions with machine tool builders followed until the blueprint stage was reached. The next step was review of proposals, and machine and equipment designs of machine builders. With concrete engineering information to go on, processing cost and machine efficiency estimates could be made. Based on these and other basic considerations discussed previously, necessary changes were recommended and equipment and machine orders placed. One of the important factors was the chip-handling system. An above-floor, dry chip, drag chain sys-

Fig. 5. Close-up of multispindle drill head used in transfer drilling operations on cylinder block.



Cylinder Head Machining Line.



CODE: E - Electrical
H - Hydraulic

OPERATIONS

Other operations are shown on reverse side.

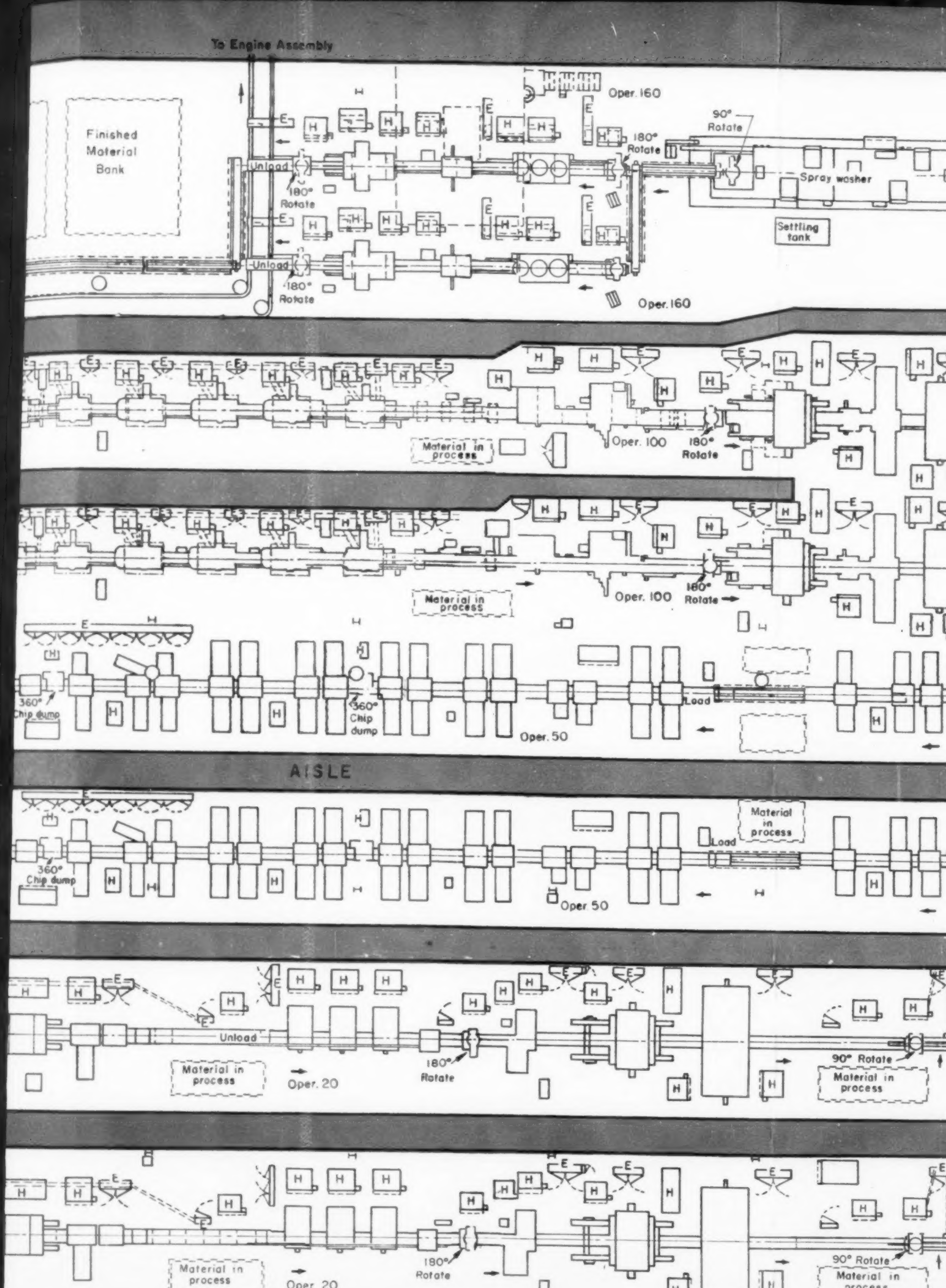
Oper. 10
Mill loc. spots, rough bore brgs., rough & finish mill pan rail, drill & ream (10) dowel holes and (2) locating holes.

Oper. 20
Mill front, rear & notches of crank brgs. Mill top radius & oil filter pad. Rough & semifinish mill banks. Rough bore cylinders.

Oper. 30
Rough & finish mill the ends, drill all gallery holes & all misc. holes in each end.

Oper. 40
Drill, ream & chamfer all holes from pan rail side.

Oper. 50
Drill ream & chamfer all ho
in banks & misc. holes in t



Oper. 30
ugh & finish mill the ends, drill gallery holes & all misc. holes each end.

Oper. 40
Drill, ream & chamfer all holes from pan rail side.

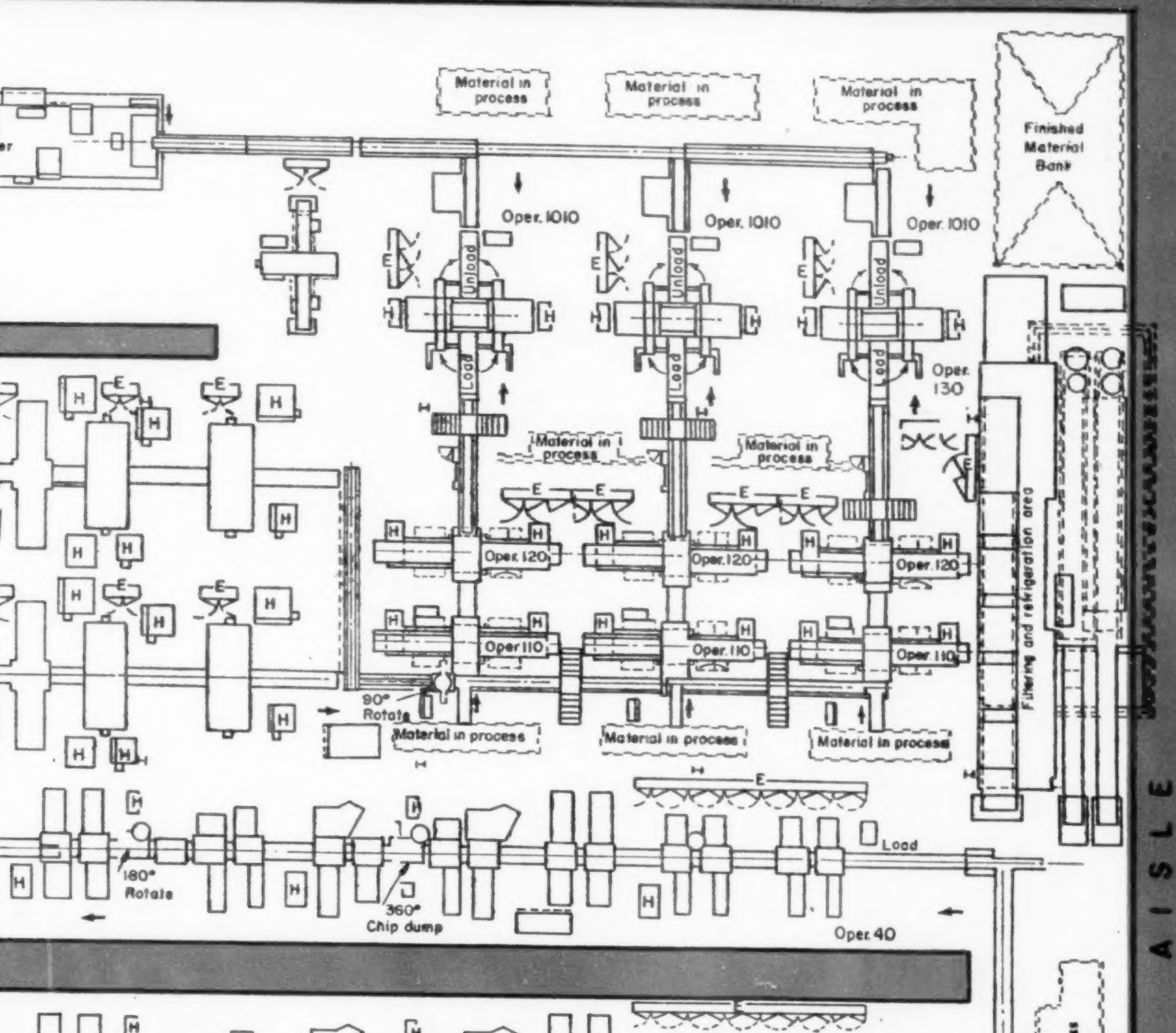
Oper. 50
Drill ream & chamfer all holes in banks & misc. holes in top.

Oper. 60
Finish ream tappet holes & tap all screw holes.

Oper. 80
Assemble brg. caps.

Oper. 90
Rough & finish bore cam brgs. Rough & semifinish crank brgs. Rough & finish oil slinger, finish mill end of rear brg.

Oper. 100
Press in cam bushing, crank & cam brgs., di (2) dowel holes in rea banks, chamfer cyl. bor semi & finish bore cyli



. 100
cam bushing, finish bore
cam brgs., dist. hole, ream
el holes in rear end, finish mill
hamfer cyl. bores top & bottom,
finish bore cylinders.

Oper. 110
Rough hone cyl. bores.

Oper. 120
Finish hone cyl. bores.

Oper. 130
Finish hone main brgs.

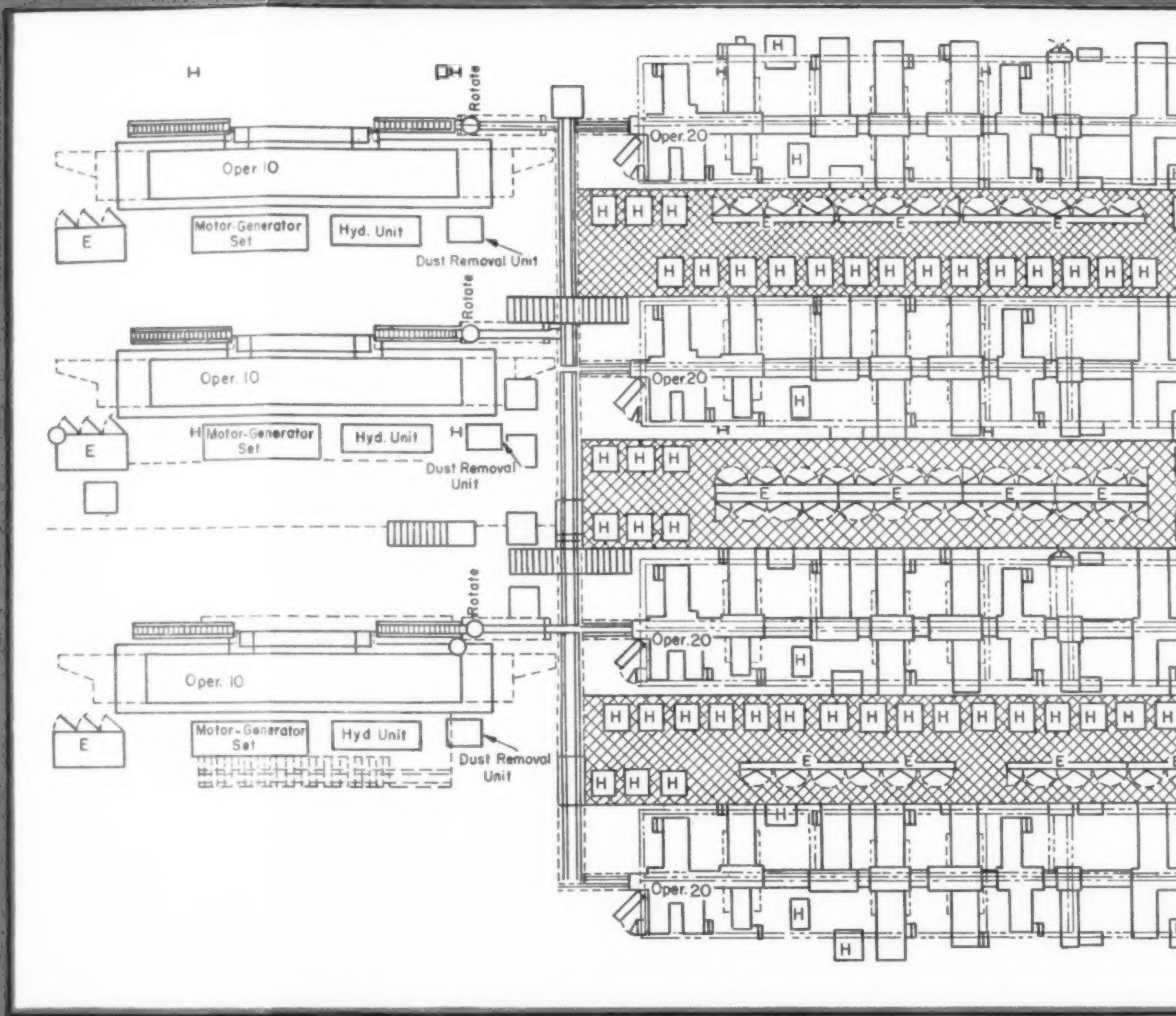
Oper. 1010
Inspection; mark bore size

Oper. 160
Assemble welch plugs, air test & mill off (4) lugs.

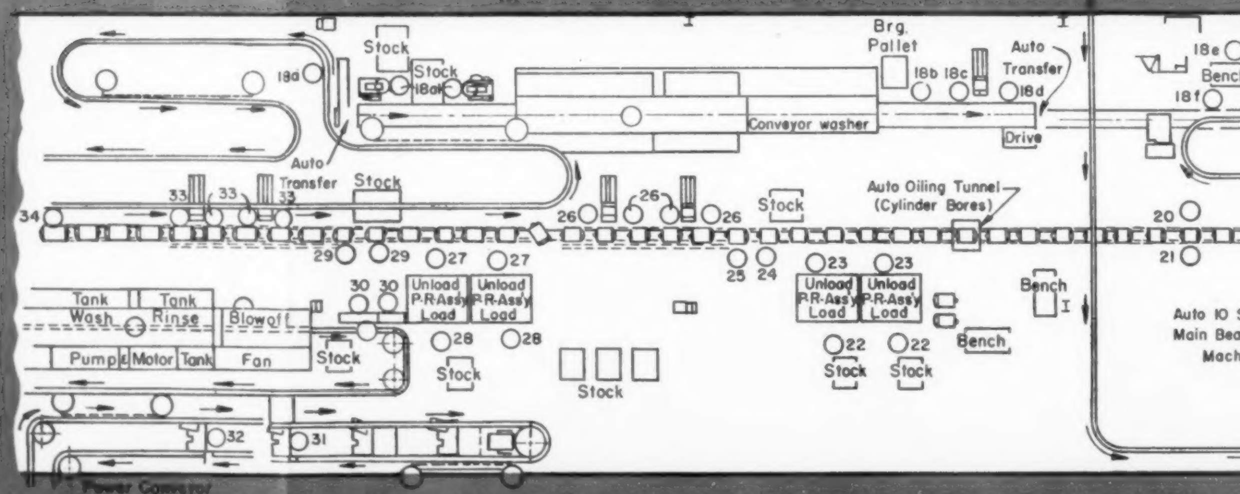
Oper. 15
Broach half round, edge & joint faces.

Oper. 25
Turn groove, drill, tap & ream holes spot face, mill locking slots & separate.

Cylinder Block Machining Line.



Beginning Section of Engine Assembly Line.



OPERATIONS CODE:

(HMT), Hydromatic Transmission

O-1 Load sheet metal parts on conveyor (hook).

O-2 Apply cement to sheet metal parts.

O-3 Assm. camshaft, drive (2) pipe plugs.

O-4 Assm. thrust plate.

O-5 Drive (2) cup plugs.

O-6 Drive (2) dowels & (1) cup plug, drive (1) cam hole plug & (1) pipe plug.

O-7 Inspect rear cam brg. plug for leaks.

O-8 Assm. housing with bolts & lock washers.

O-9 Assm. (2) bolts & lock washers make up (6) bolt & washer assy.

O-10 Finish face, bore, c'bore & chamfer end.

O-11 Inspect pilot dia. & squareness of face.

O-12 Loosen (10) brg. cap bolts

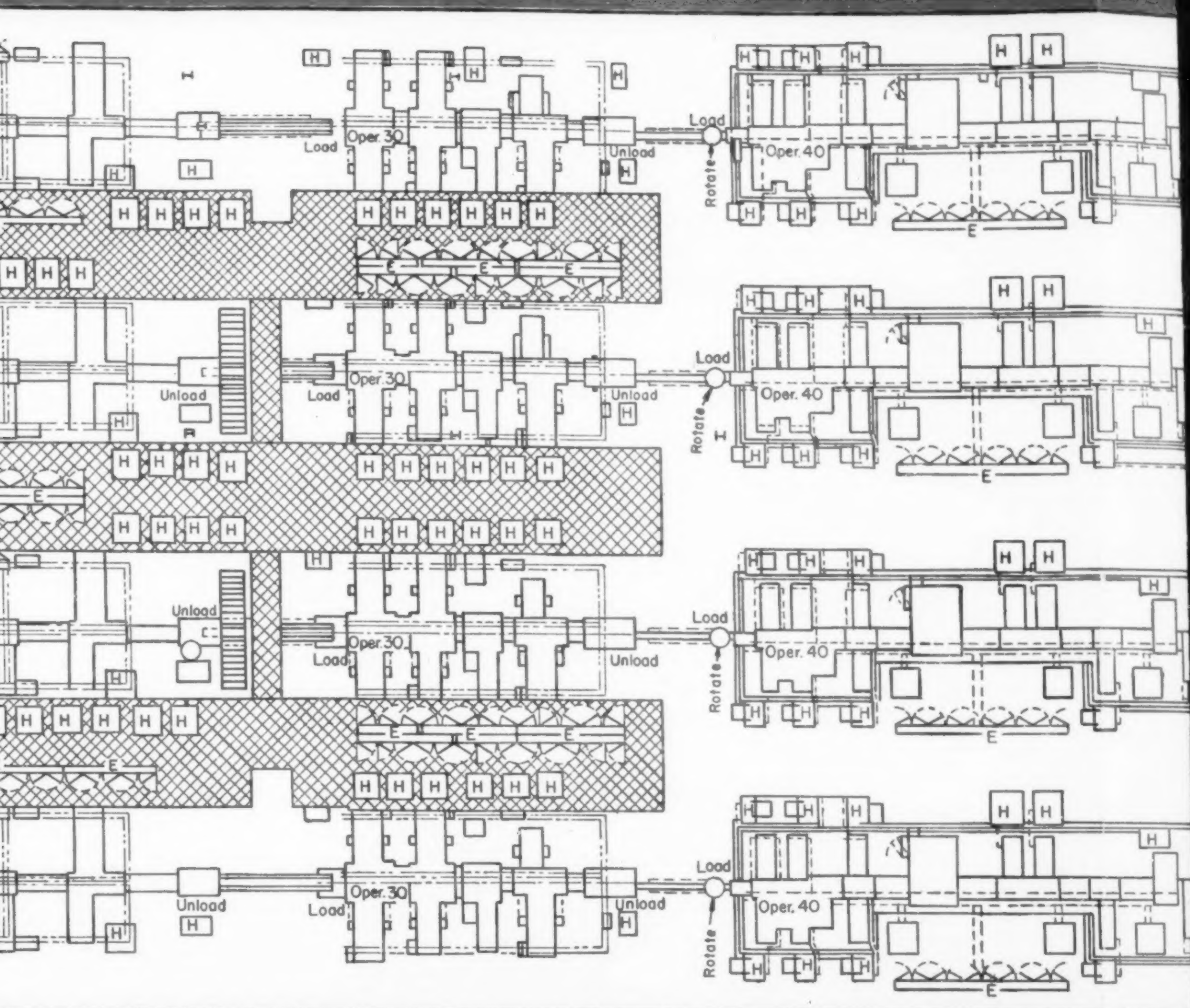
O-13 Remove bolts & cap & place in tray & brush.

O-14 Assm. oil seal to block complete & turn engine

O-15 Turn engine 90° & ass oil seal to cap comple

edge & joint faces.

separate.



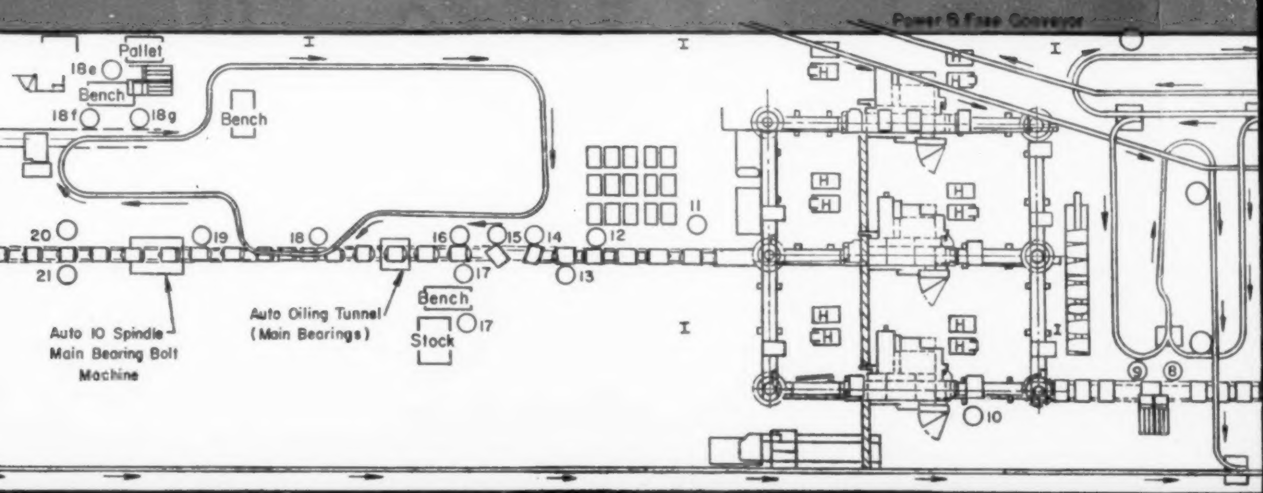
OPERATIONS

Oper. 10
Broach connecting faces.

Oper. 20
Drill, ream, mill c'bore & chamfer

Oper. 30
Drill, tap, ream, core drill & chamfer

Ope
Finish
press
spot



bolts & cap &
tray & brush.

l seal to block
& turn engine 90°.

gine 90° & assm.
to cap complete.

O-16
Assm. brg. inserts to block.

O-17
Assm. brg. inserts to caps.

O-18
Assm. crank shaft & flywheel assy. Assm. rear main brg. cap with (2) bolts.

O-19
Assm. (4) caps with bolts & lock washers to engine.

O-20
Inspect for tight crank.

O-21
Repair tight crank.

O-22
Assm. (2) comp. rings (1) oil ring & burr ring grooves.

O-23
Select (2) piston assys. & assm. brg. inserts, place on block stock shells.

O-24
Align oil rings on (2) assys., stick & oil.

O-25
Align oil rings on (2) assys., stick & oil.

O-26
Pull & tie up (1) piston & rod assy. to crank complete.

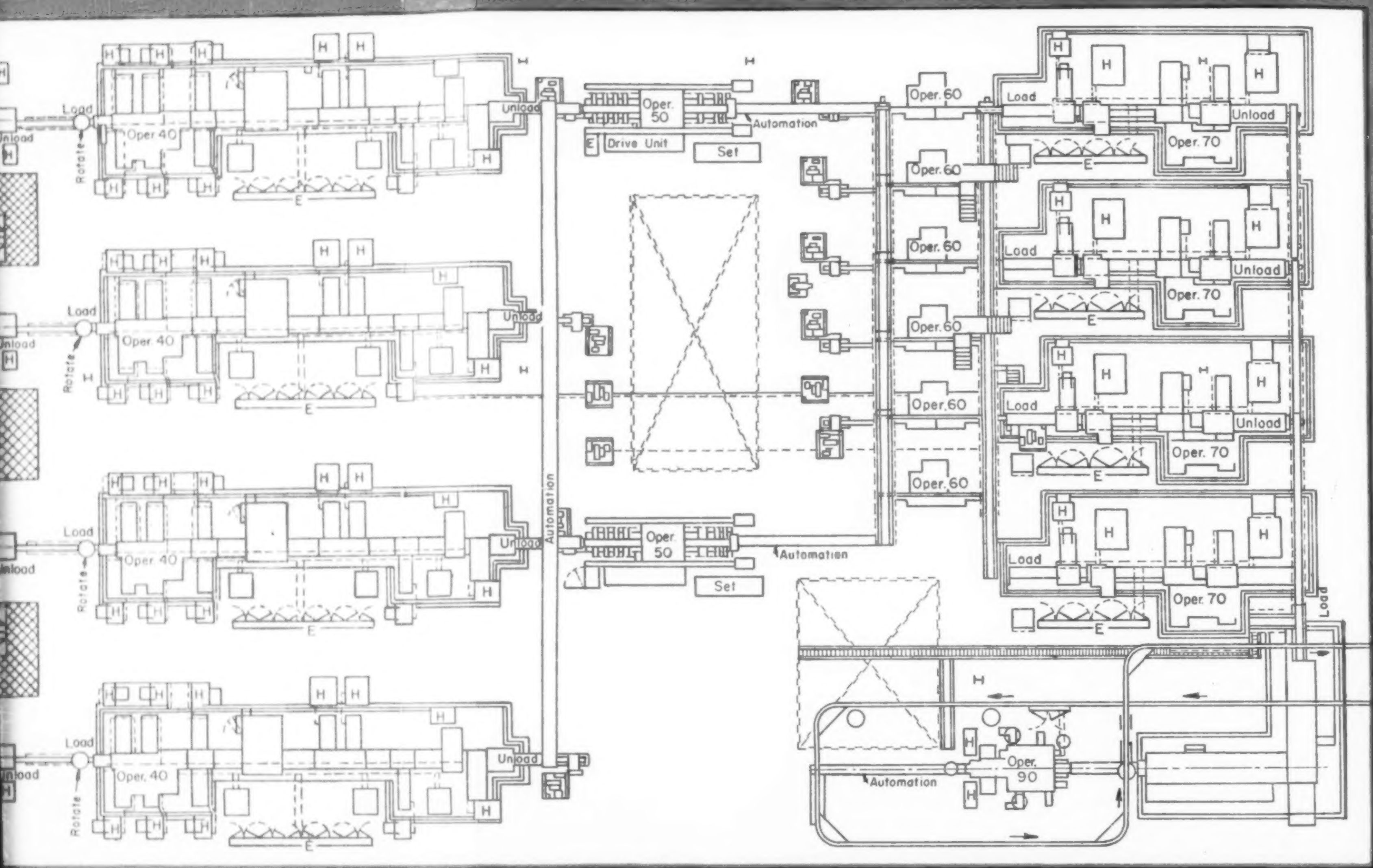
O-27
Select (2) piston assys. & assm. brg. inserts, place on block.

O-28
Assm. (2) comp. rings (1) oil ring & burr ring grooves.

O-29
Align oil ring
assys., stick

O-30
Assm. exp. r

O-31
Assm. piston



0
acting faces.

Oper. 20
Drill, ream, mill c'bore & chamfer

Oper. 30
Drill, tap, ream, core drill & chamfer

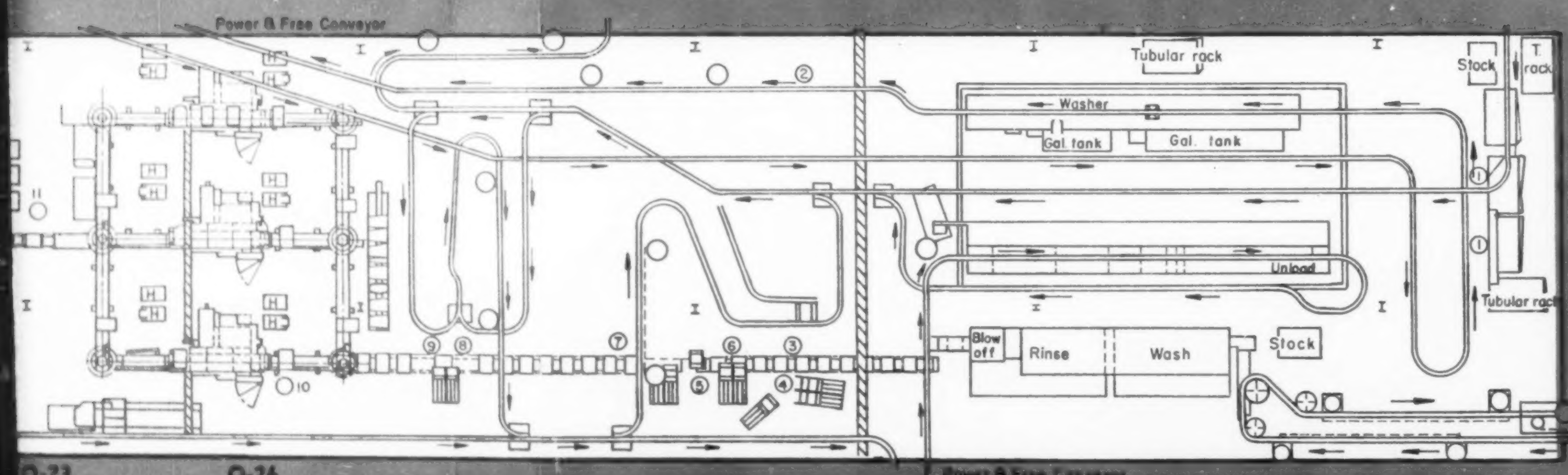
Oper. 40
Finish bore & ream, press in valve guide, spot face & ream guides.

Oper. 50
Finish broach joint face.

Oper. 60
Profile mill comb, chambers.

Oper. 70
C'bore & chamfer spark plug holes, tap all holes. Drill (1) hole thru oil gallery.

Oper. 90
Assem. plugs & air test.



O-23
Select (2) pistn assys. & assm. brg. inserts, place on block stock shells.

O-24
Align oil rings on (2) assys., stick & oil.

O-25
Align oil rings on (2) assys., stick & oil.

O-26
Pull & tie up (1) piston & rod assy. to crank complete.

O-27
Select (2) piston assys. & assm. brg. inserts, place on block.

O-28
Assm. (2) comp. rings (1) oil ring & burr ring grooves.

O-29
Align oil rings on (2) assys., stick & oil.

O-30
Assm. exp. rings.

O-31
Assm. piston pin & rod LH.

O-32
Assm. piston pin & rod RH.

O-33
Pull & tie up (1) piston & rod assy. to crank.

O-34
Hand torque (8) rod nuts.

O-18a
Get c/s from del. conv. load thru demag.

O-18a-1
Balance HMT flywheel & hang on conveyer.

O-18b
Assm. & stake pilot brg. Wipe flange & apply sealer (HMT).

O-18c
Assm. flywheel to crank get (6) bolts & place in sealer.

O-18d
Get (6) bolts & start rundown & tighten.

O-18f
Indicate for runout correct (HMT).

O-18e
Balance clutch plates synchromesh trans. Wipe & oil pressure plates. Assm. bolts & lockwashers to plates, position clutch, pressure plate.

O-18g
Test for leaks (HMT).

a was settled on for the cylinder block, cylinder ad and other cast-iron machining lines for accesility. This system was dovetailed with other uipment, or machine designs were modified to commodate it. Above-floor type installation relted from a distillation of others' experience with aintenance and repairs to flush types.

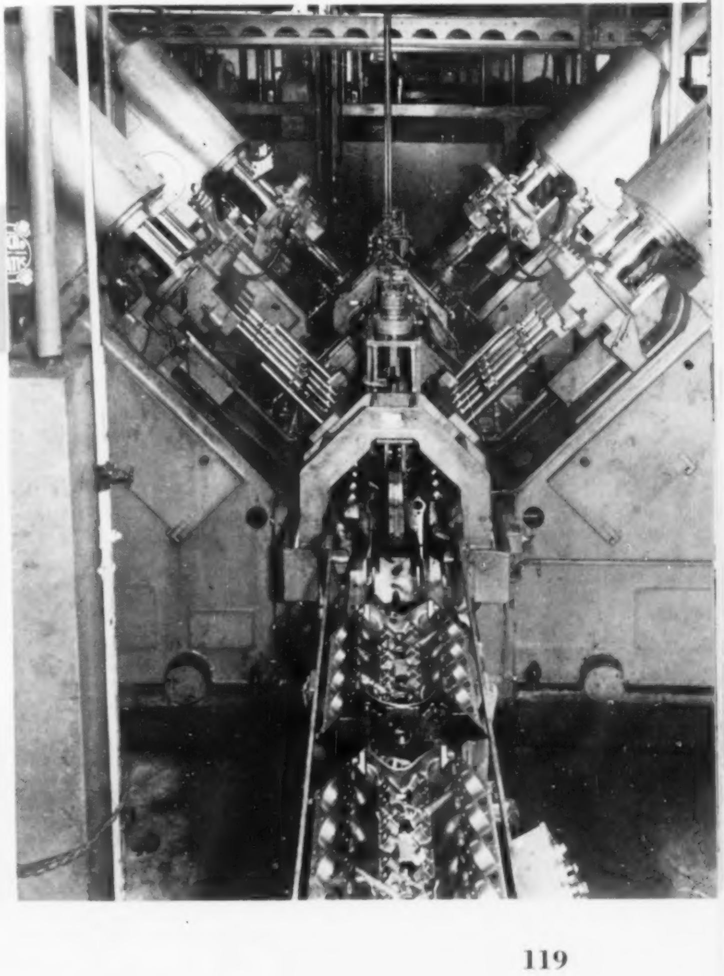
Location of line: One of the major questions was whether to utilize the old engine building for the new line or to go to a new building. This problem was complicated by several factors. Since production had to be maintained during the time that the new engine plant was being tooled up, the entire old production establishment would have to be moved if this building were to be used. This location was ideal, physically, however, being between the foundry where block and head castings are produced, and the final car assembly line. If the new engine production were set up in another location, castings would have to be transported a long distance, probably by an overhead conveyor. Finished engines would then have to be brought back to the final assembly line. This would have greatly complicated scheduling and handling, without considering expense involved. From a cost viewpoint alone, it was estimated that construction of an overhead conveyor system would run more than to move the old engine line. A survey also disclosed that the old engine plant could be moved and production maintained. The new automation engine line could be placed on the location by rehabilitating the building facilities, though at a cost probably greater than a new building.

The final decision was dictated by the physical location and greater manufacturing efficiency inherent in it. Move of the old engine line was undertaken and by careful preplanning was completed in November of 1952 over a period of approximately four months without loss of production. This bit of industrial legerdemain was accomplished by picking up sections of the line piecemeal, beginning from the finish end and progressing backward to the start. Each section built up a bank of parts previous to its move so that production could be maintained. As it worked out no more than 12 to 14 hours' actual manufacturing time was lost by any one section.

Many other physical problems of lesser scope occurred in laying out the new lines. One of these was to establish a uniform machine table height for automation purposes. Variations were found to exist among machine builders as to reference points in machine bases from which table heights are measured. Another difficulty was to find a com-

Fig. 6. Automatic turnover station with blocks emerging from transfer drilling line preparatory to entering wash station.

Fig. 7. Cylinder blocks with honing operation completed are moving to gaging station. Automatic machine in background performs rough hone, one in foreground does finishing.



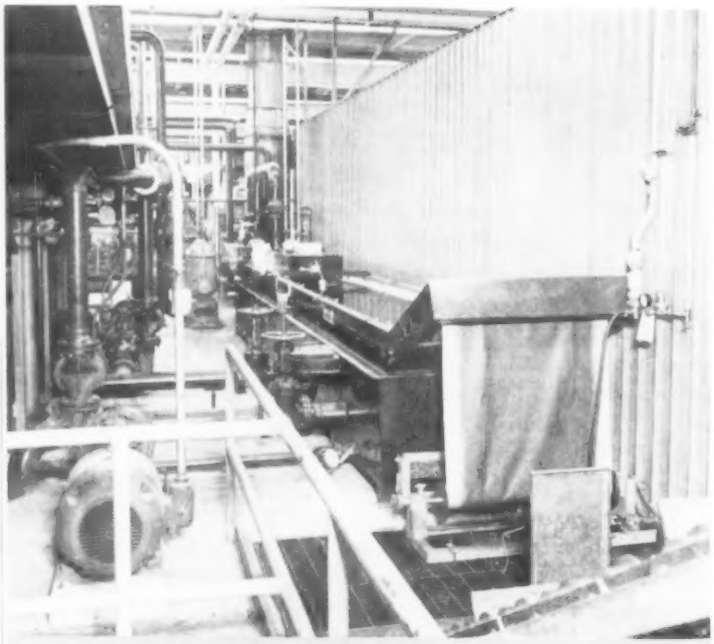
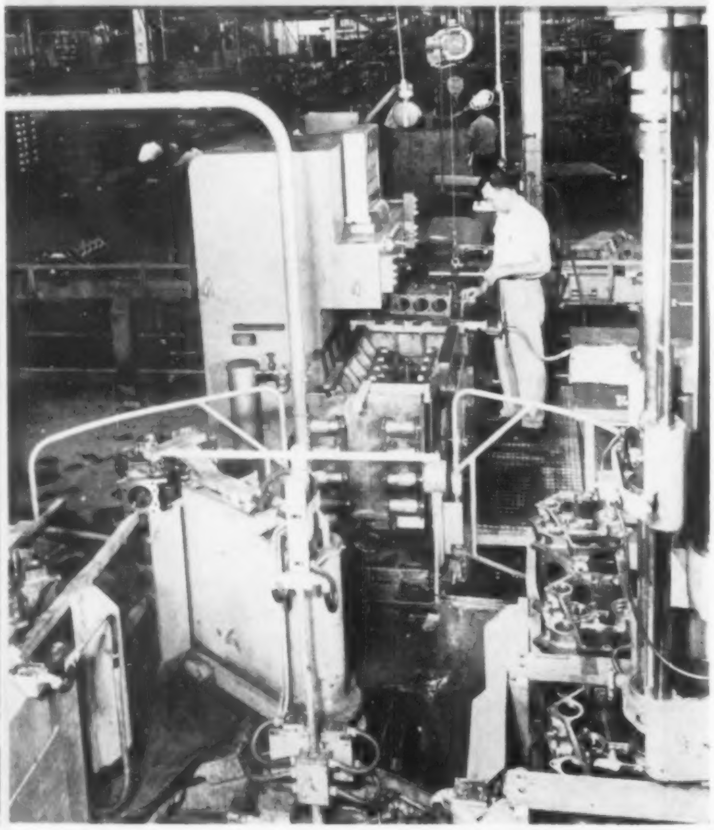


Fig. 8. Refrigeration and filtering system for home coolant. After passing through double continuous paper filter the coolant goes through refrigeration system to cool to 70 F, then back to machines.

Fig. 9. Gaging and marking station for cylinder bores receives blocks immediately after they leave honing operation.



mon floor plane since most shop floors are built up in several layers and considerable variation is likely to occur in the elevation in a bay several hundred feet in length. So landmarks were set up as reference points to establish table heights.

Because of the wide variety of machines ordered, base specifications varied considerably. The machine builder's specifications were carried out, however, regardless of the additional problems involved, as it was felt this would prove worth while in promoting trouble-free operation. Footings varied up to a thickness of 6 feet of reinforced concrete.

Other Layout Problems: Pouring machine foundations involved another problem. From past experience company engineers were aware that often preliminary footing dimensions might vary somewhat in the final machine. Yet it was necessary to proceed in setting up machine foundations in order to meet scheduled production dates. A simple but ingenious solution was found by imbedding 18-inch steel pots at approximate location points. These were spiraled somewhat like corrugated culvert stock so that they were firmly held in the concrete. Machines could then be installed without the necessity of relocating anchor points if a preliminary dimension proved to be inaccurate.

Another difficulty was location of power panels, as floor space was at a premium and considerable uncertainty existed over final sizes. In some cases this was resolved by placing these units on a platform at mezzanine level, as shown in the bearing cap machining area at the end of the block line in the plant layout, and at the beginning of the head line. This type of location offers two advantages. Maintenance work can be carried on with least interference to production and floor space is gained.

Major Machining Lines

The cylinder block and cylinder head lines are the most highly automated in the plant, and likewise presented the most complex tooling problems. The cylinder head is machined in completely automated equipment, running the length of the bay. Broaching is used extensively, as shown in layout.

Automatic transfer has been refined to a high level so that production of the cylinder head is coordinated between machines of unequal productive capacity. Thus three identical horizontal machines in the beginning operation broach the manifold and connecting faces. From these the cylinder heads feed into four lines of transfer machines for milling, drilling, reaming operations, etc. These in turn feed into two broaching machines which finish

machining the connecting faces, whereupon the line again splits into four parts for milling the combustion chambers and remaining operations.

Many improvements have been made in the transfer equipment used on the head line, both in integrating gaging and in making operation more automatic and foolproof. The cylinder block, however, representing the backbone of the engine and being the largest single component, will be described in detail. The layout is shown beginning on p. 113.

Milling is used exclusively for machining surfaces of the cylinder block.

Transferring and locating a workpiece of this size is a study in itself. The block slides on a rail system, positioned on the four corner locating lugs when oriented pan side up. The automation conveyors thus precisely control position and attitude during transfer of part. Nearly all conceivable positions are used in transferring between stations, sidewise, in-line, both pan side up and in car-installation position, and with each end forward at times.

Chip removal is accomplished by automatic turnover, often at stations requiring reorientation of the block. Blowoff by air is used at locating stations to insure precise workholding and at only one other point for chip removal.

Cylinder block castings are machined on two lines of transfer machines, in which both machines and operation are duplicates, except that one spray washer serves both near the end of the line. Length of each line is over 1200 feet. Thus, the area occupied by the block machining department is the greatest for any single component. Double lines were needed to provide the volume of production required besides assuring continuous production. Rough castings received from foundry inspection are loaded by manually controlled electric hoist on the automation conveyor at the beginning of the line, *Fig.* 4. The block is oriented in upright position as installed in the car chassis. The first operation is milling locating spots on four corner lugs for use in transferring and positioning the block for later operations. The block is vertically rotated 180 deg for operations to be performed from the bottom, then transferred to the second station. In the remaining stations of this machine the crank bearings and rear cam bearing are rough bored, the pan rail is milled in two operations; and 10 dowel and 2 locating holes are drilled and reamed. These operations are performed on a 10-station, milling and drilling transfer machine.

Automation conveyors carry the block to the next transfer machine where in ten stations the end crank bearings are milled, the bearing notches are

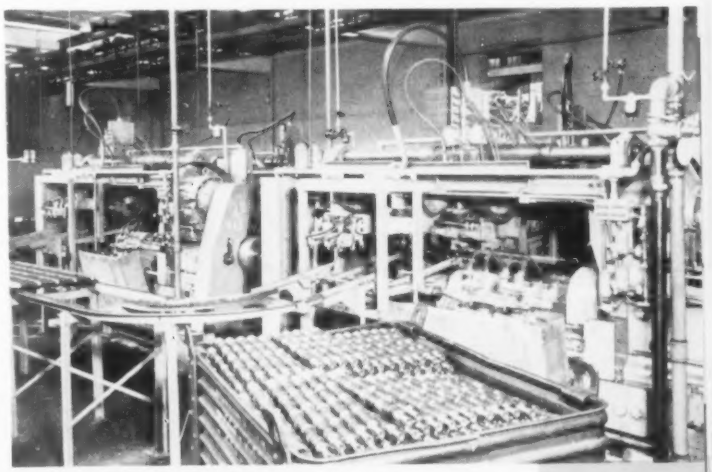


Fig. 10. (below) Crankshaft unloader moves parts automatically to next operation after completion of operation of turning main bearings.

Fig. 11. (right) Automatic turning and gaging of camshaft is performed in two special machines, each comprising two lathes. Gaging unit is shown at left side of lathe above unloading chute.

milled. The block is vertically rotated 180 deg for chip removal and to orient it for topside operations. These include milling the top radius and oil filter pad, and rough and semifinish face milling the banks. The cylinders are also rough bored in this unit.

Before entering the last transfer machine in this bay, the block is rotated 90 deg horizontally. Operations performed in this 18-station machine consist of rough and finish milling the ends, drilling the oil gallery holes and all miscellaneous holes in each end.

An automation conveyor transfers the blocks from the two identical lines at right angles and feeds them into the two lines of transfer machines where the blocks move back down the line at opposite direction to the first bay. Primarily drilling operations are handled in this bay, *Fig.* 5. The first machine takes the block in the upside-down position and drills, reams and chamfers all holes from the pan rail side in a series of 25 stations. In the process the block is rotated a full 360 deg for chip removal at an intermediate point, shown on plant layout, and then 180 deg to reposition it.

Other transfer machines in this bay include one of 27 stations which drills, reams and chamfers all holes in the banks and miscellaneous holes in the top of the block. There are two 360-deg chip dumping rotations in this operation. The last machine in this group finish reams the tappet holes and taps all screw holes in a series of 17 stations.

In reaming holes in the block, the tools are maintained at an even operating temperature by means of induction heaters. This is symbolic of the care which has been used throughout the plant to eliminate variables which may affect quality. It also explains graphically why an automatic operation can produce with more uniform parts than possible in hand operations.

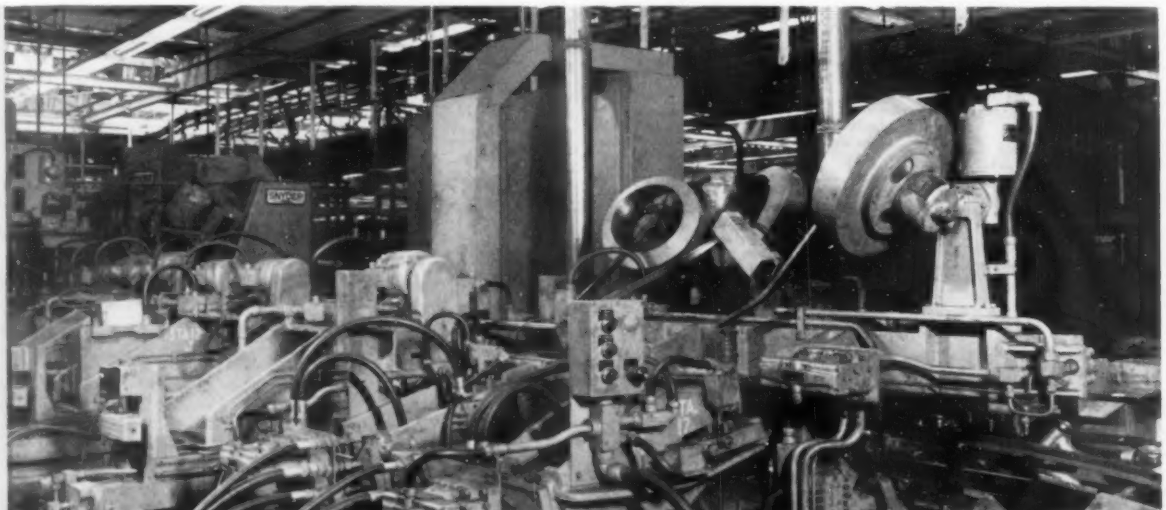
The block is transferred at right angles, *Fig.* [illegible], into a spray wash machine which cleans it in wash, rinse and blowoff steps preparatory to assembly operations. Bearing caps which have been processed in the next bay are received by conveyor and placed in position by hand, and cap bolts started. With the block in upside-down position, these bolts are run down and torqued by machine in the succeeding operation.

Two important and interesting gaging operations occur at this point before further machining. One of these, a height gage, consists merely of a flat plate located above the automation conveyor and connected to a trigger switch. The height of the plate is such that if one or more of the bearing cap bolts is incompletely assembled (due to tapping error, for example) the bolt strikes the plate, throwing the switch so that the block is moved off the line for repair. A succeeding machine gages the depth, size and location of the crankshaft openings in the block, detecting any error in bearing cap location also, *Fig.* 3.

From these stations the block moves to a 14-station transfer machine for boring the cam holes, and rough and semifinishing of the crankshaft bearings. Other operations include machining the oil slinger and finish milling the end of the rear bearing.

Next the cam bushing is positioned manually. A 10-station transfer machine then presses in the bushing, finish bores the crankshaft bearings and performs several miscellaneous operations, including dumping the chips and blowing off. The banks are finish milled, top and bottom of cylinder bores chamfer and cylinders semi and finish bored.

Fig. 12. Special automatic line transfer machine is assembling bushings and pins on exhaust manifold for butterfly valve. Other operations on part in 17 stations are milling, drilling, core-drilling, spot-facing, reaming and tapping.



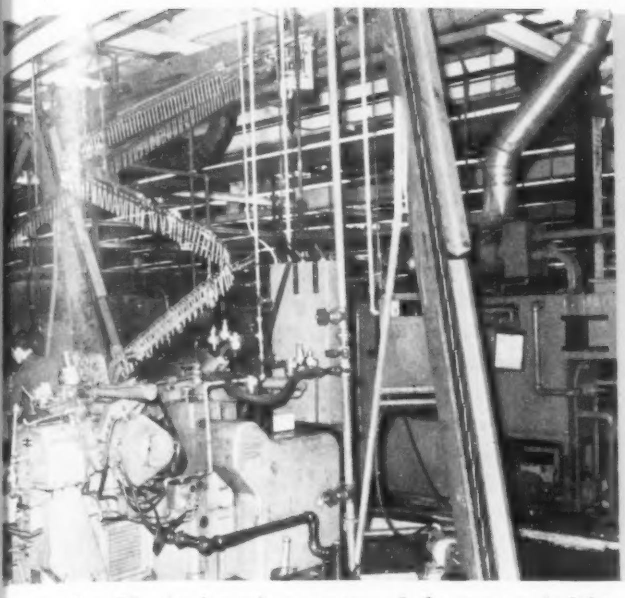


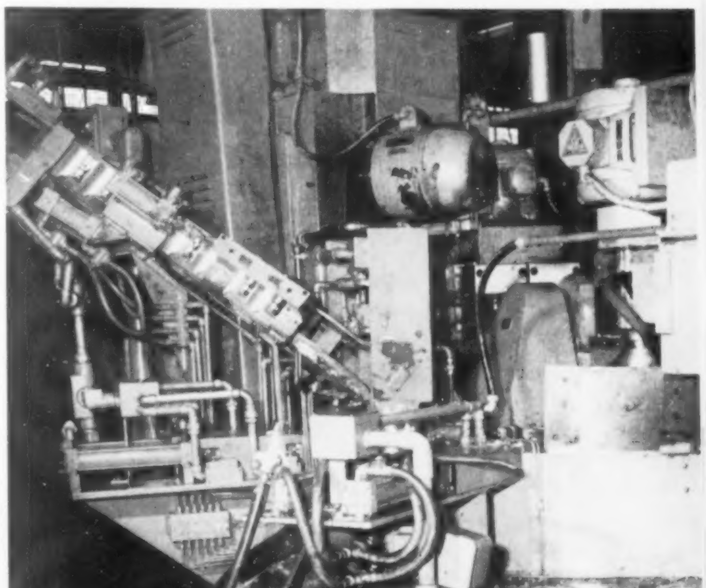
Fig. 13. An ingenious system of elevators and slides automatically moves valves between process steps.

Fig. 14. Automatic induction hardening machine tempers valves after machining.

In one of the most critical operations the blocks are rough and finish honed, *Fig.* 7, the two lines coming together into one line for processing through the battery of six automatic hones. A rough and finish hone are linked in series, in three identical stations. When the first station is in operation, the next cylinder block is shuttled to the second station; when that is operating, the next block is shuttled to the last station, permitting simultaneous operation. Operation of the hones is automatic with in-process gaging assuring bores within tolerance. Kerosene coolant for honing is maintained at a constant temperature and high level of purity by an automatic filtering and refrigeration system, *Fig.* 8. A continuous double paper, disposable filter system is used. Refrigerating of the coolant stabilizes the block temperature for both the honing and following gaging operation, *Fig.* 9. The block bores are gaged in steps of 0.00025 inch and marked. In assembly, pistons gaged and sorted in the same steps at the same temperature, are mated to the cylinders, assuring a precision fit, which Pontiac design engineers feel will afford longer life and better performance.

From the bore gaging the line again reverses direction and returns in a single line through a spray washer. Leaving the washer the line splits again in two duplicates for assembly of Welch casting hole plugs, air testing and milling off the four locating lugs. These operations are performed in a nine-station transfer machine. After unloading from this machine and Brinell testing, blocks are loaded on overhead conveyor for transporting to

Fig. 15. Pistons leaving automatic 3-stage washer. Pistons are thoroughly cleaned and the temperature regulated in temperature control room for 16 minutes before gaging.



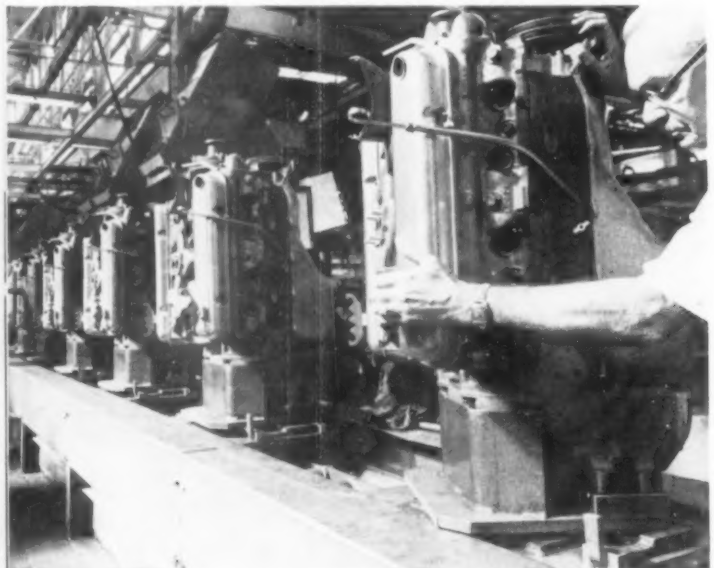
the final assembly line in another building.

Many other interesting operations could be selected from manufacture of other components, automatized to varying degrees. Some of the most outstanding are described in the following paragraphs:

Automatic operations are extensively employed in machining, grinding and balancing the crankshaft, *Fig.* 10. Batteries of like machines are grouped and parts are moved between operations by a power-and-free conveyor system which carries completed parts to the final assembly line. Other types of conveyors are also used, including trunnion elevating type.

One of the most highly developed operations in camshaft production is the rough and finish turning in automatic lathes, *Fig.* 11. Gaging of completed workpieces is performed automatically at completion of each step and the machine is shut down if out-of-tolerance parts are produced. The operation is more completely described in the May '54 issue of THE TOOL ENGINEER, page 43.

Fig. 16. Section of engine assembly line shortly after block emerges from final wash. Assembly "house" has air filtered to avoid contamination of moving parts. Plant layout shows section in detail.



Typical of many of the small components, production of manifolds has been automated to a considerable degree with some assembly operations mechanized. The transfer machine that processes exhaust manifolds, *Fig.* 12, is especially interesting. The line-index, top-transfer mechanism is suspended above the part by bridges at each machine station. An unusual feature is that pairs of the awkwardly shaped workpieces are handled without use of pallet fixtures. Both right and left-hand parts are carried through the machine simultaneously. Milling, drilling, core-drilling, spotfacing, reaming and tapping operations are performed as the parts pass through, including a series of operations on the discharge neck of the part at right angles to the centerline of the neck. These are accomplished by the use of units with pincher-like heads mounted on platens which move into the line of transfer and drill opposite sides of the neck, the centerline of the drills being parallel to the line of transfer.

Of special interest also is a maze of ingenious elevators, chutes and slides, *Fig.* 13, that has been employed in processing valves for transfer between operations. One of the final steps is automatic induction hardening, *Fig.* 14.

Cleanliness Assures Quality

Pontiac engineers insist that cleanliness is akin to quality. For example, piston production features a three-stage wash, *Fig.* 15, before entering a refrigerated temperature control room prior to gaging. All the other major mechanical parts such as crankshaft, camshaft, connecting rods, manifolds, and miscellaneous other parts as well as block and head are thoroughly cleaned before assembly and in some cases before each separate subassembly.

It is in the final assembly of the engine that this creed of cleanliness is carried to fulfillment. The assembly "house" is walled off, pressurized, air conditioned and filtered. Storage parts are sealed and the block receives a final wash before its start down the line, *Fig.* 16. Purchased parts are manufactured to the same standards and any critical fittings or openings are covered for shipment.

The latter stages of the final assembly line move individual engines by power-and-free conveyor for many of the installation and assembly operations where, lacking completely automatic equipment, power tools are widely used. After completion, the engines go to the test stands, arranged in a space-saving merry-go-round, *Fig.* 1. From here the engines go by the same conveyor system to the automotive assembly line for installation.

According to Buel Starr, the last hurdle in fruition of the manufacturing philosophy that established this outstandingly modern plant is training the labor force to operate it. Until September the line was only in pilot operation. With but a few short weeks for personnel to familiarize themselves with completely new equipment, many hitches developed, but operations are smoothing out and stoppages are diminishing as production increases, and the goal is within sight.

Coordinates for Holes on Bolt Circles

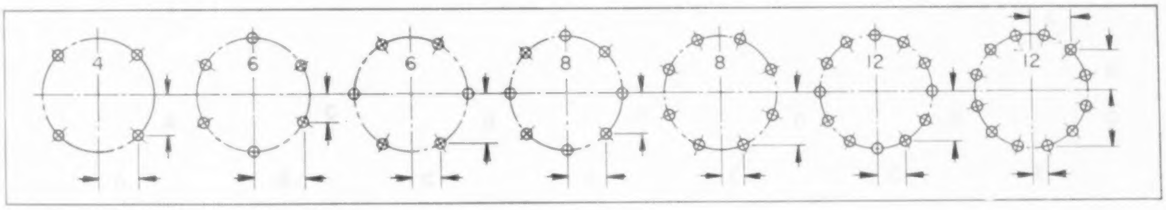
By George A. Nelson*
Nelson Template Co.
Hollywood, Calif.

Although the locations of centers for holes on bolt circles can easily be computed, the calculations for several bolt circles can be time consuming. The table on this and the next page gives coordinates for 4, 6, 8 and 12 holes on bolt circles with diameters from 1/4 to 8 inches.

The table is used simply by determining the attitude of the holes in relation to the axes of the bolt circle, selecting the letter dimensions for the corresponding sketch, following the row across from the bolt circle diameter and reading the coordinate values under the correct letter dimensions. If finer increments of bolt circle diameter are used, coordinate values can easily be interpolated.

When it is desired that an assembly be mounted in only one attitude, a locating pin can be included or one hole can be purposely displaced. The latter can be accomplished by displacing one hole off the bolt circle or, for repeatable results, by using coordinates for a hole on the same diameter bolt circle but with a different number of bolts. For example, one hole could be displaced on a 6-bolt circle by using the coordinates for a hole on an 8-bolt circle.

*Senior member ASTE Los Angeles chapter.



Dimensions for hole center coordinates.

Bolt Circle Dia	A	B	C	D	E	F	G
1/4	0.0884	0.1083	0.0625	0.1155	0.0478	0.0325	0.1207
9/32	0.0994	0.1218	0.0703	0.1299	0.0538	0.0364	0.1358
5/16	0.1105	0.1353	0.0781	0.1444	0.0598	0.0404	0.1509
11/32	0.1215	0.1488	0.0859	0.1588	0.0658	0.0445	0.1660
3/8	0.1326	0.1624	0.0937	0.1732	0.0718	0.0485	0.1811
13/32	0.1436	0.1759	0.1015	0.1877	0.0777	0.0526	0.1962
7/16	0.1547	0.1894	0.1094	0.2021	0.0837	0.0566	0.2113
15/32	0.1657	0.2030	0.1172	0.2165	0.0897	0.0607	0.2264
1/2	0.1768	0.2165	0.1250	0.2310	0.0957	0.0647	0.2415
9/16	0.1989	0.2436	0.1406	0.2598	0.1076	0.0728	0.2717
5/8	0.2210	0.2706	0.1562	0.2887	0.1196	0.0809	0.3018
11/16	0.2431	0.2977	0.1718	0.3176	0.1315	0.0890	0.3320
3/4	0.2652	0.3248	0.1875	0.3465	0.1435	0.0971	0.3622
13/16	0.2873	0.3518	0.2031	0.3753	0.1555	0.1051	0.3924
7/8	0.3094	0.3789	0.2187	0.4042	0.1674	0.1132	0.4226
15/16	0.3315	0.4059	0.2343	0.4331	0.1794	0.1213	0.4528

Bolt Circle Dia	A	B	C	D	E	F	
1	0.3535	0.4330	0.2500	0.4619	0.1913	0.1294	0.4810
1/16	0.3756	0.4601	0.2651	0.4908	0.2033	0.1375	0.5111
1/8	0.3977	0.4871	0.2812	0.5197	0.2153	0.1456	0.5413
3/16	0.4198	0.5142	0.2968	0.5486	0.2272	0.1537	0.5715
1/4	0.4419	0.5413	0.3125	0.5774	0.2392	0.1618	0.6037
5/16	0.4640	0.5683	0.3281	0.6063	0.2511	0.1699	0.6339
3/8	0.4861	0.5954	0.3437	0.6352	0.2631	0.1779	0.6641
7/16	0.5082	0.6225	0.3593	0.6640	0.2751	0.1860	0.6942
1/2	0.5303	0.6495	0.3750	0.6929	0.2870	0.1941	0.7244
9/16	0.5524	0.6766	0.3906	0.7218	0.2990	0.2022	0.7546
5/8	0.5745	0.7036	0.4062	0.7507	0.3109	0.2103	0.7848
11/16	0.5966	0.7307	0.4218	0.7795	0.3229	0.2184	0.8150
3/4	0.6187	0.7578	0.4375	0.8084	0.3348	0.2265	0.8452
13/16	0.6408	0.7848	0.4531	0.8373	0.3468	0.2346	0.8754
7/8	0.6629	0.8119	0.4687	0.8661	0.3588	0.2426	0.9055
15/16	0.6850	0.8390	0.4843	0.8950	0.3707	0.2507	0.9357
2	0.7071	0.8660	0.5000	0.9239	0.3827	0.2588	0.9659
1/16	0.7292	0.8931	0.5156	0.9528	0.3946	0.2669	0.9961
1/8	0.7513	0.9201	0.5312	0.9816	0.4066	0.2750	1.0263
3/16	0.7734	0.9472	0.5468	1.0105	0.4186	0.2831	1.0565
1/4	0.7955	0.9743	0.5625	1.0394	0.4305	0.2912	1.0867
5/16	0.8176	1.0013	0.5781	1.0682	0.4425	0.2993	1.1168
3/8	0.8397	1.0284	0.5937	1.0971	0.4544	0.3073	1.1470
7/16	0.8618	1.0555	0.6093	1.1260	0.4664	0.3154	1.1772
1/2	0.8839	1.0825	0.6250	1.1548	0.4783	0.3235	1.2074
9/16	0.9060	1.1096	0.6406	1.1837	0.4903	0.3316	1.2376
5/8	0.9281	1.1367	0.6562	1.2126	0.5023	0.3397	1.2678
11/16	0.9502	1.1637	0.6718	1.2415	0.5142	0.3478	1.2979
3/4	0.9723	1.1908	0.6875	1.2703	0.5262	0.3559	1.3281
13/16	0.9944	1.2178	0.7031	1.2992	0.5382	0.3640	1.3583
7/8	1.0165	1.2449	0.7187	1.3281	0.5501	0.3721	1.3885
15/16	1.0386	1.2720	0.7343	1.3569	0.5621	0.3801	1.4187
3	1.0606	1.2990	0.7500	1.3858	0.5740	0.3882	1.4489
1/16	1.0827	1.3261	0.7656	1.4147	0.5860	0.3963	1.4791
1/8	1.1048	1.3532	0.7812	1.4436	0.5979	0.4044	1.5092
3/16	1.1269	1.3802	0.7968	1.4724	0.6099	0.4125	1.5394
1/4	1.1490	1.4073	0.8125	1.5013	0.6218	0.4206	1.5696
5/16	1.1711	1.4343	0.8281	1.5302	0.6338	0.4287	1.5998
3/8	1.1932	1.4614	0.8437	1.5590	0.6458	0.4368	1.6300
7/16	1.2153	1.4885	0.8593	1.5879	0.6577	0.4448	1.6602
1/2	1.2374	1.5155	0.8750	1.6168	0.6697	0.4529	1.6904
9/16	1.2595	1.5426	0.8906	1.6457	0.6816	0.4610	1.7205
5/8	1.2816	1.5697	0.9062	1.6745	0.6936	0.4691	1.7507
11/16	1.3037	1.5967	0.9218	1.7034	0.7056	0.4772	1.7809
3/4	1.3258	1.6238	0.9375	1.7323	0.7175	0.4853	1.8111
13/16	1.3479	1.6509	0.9531	1.7611	0.7295	0.4934	1.8413
7/8	1.3700	1.6779	0.9687	1.7900	0.7414	0.5015	1.8715
15/16	1.3921	1.7050	0.9843	1.8189	0.7534	0.5096	1.9017
4	1.4142	1.7320	1.0000	1.8477	0.7653	0.5176	1.9318
1/8	1.4584	1.7861	1.0312	1.9055	0.7892	0.5338	1.9922
1/4	1.5026	1.8403	1.0625	1.9632	0.8131	0.5499	2.0525
3/8	1.5468	1.8944	1.0937	2.0209	0.8371	0.5661	2.1129
1/2	1.5909	1.9485	1.1250	2.0787	0.8610	0.5823	2.1733
5/8	1.6351	2.0026	1.1562	2.1364	0.8849	0.5985	2.2336
3/4	1.6793	2.0568	1.1875	2.1942	0.9088	0.6146	2.2940
7/8	1.7225	2.1109	1.2187	2.2519	0.9327	0.6308	2.3544
5	1.7677	2.1650	1.2500	2.3097	0.9567	0.6470	2.4148
1/8	1.8119	2.2192	1.2812	2.3674	0.9806	0.6632	2.4751
1/4	1.8561	2.2733	1.3125	2.4251	1.0045	0.6794	2.5355
3/8	1.9003	2.3274	1.3437	2.4829	1.0284	0.6955	2.5959
1/2	1.9445	2.3815	1.3750	2.5406	1.0523	0.7117	2.6562
5/8	1.9887	2.4357	1.4062	2.5984	1.0762	0.7279	2.7166
3/4	2.0329	2.4898	1.4375	2.6561	1.1002	0.7441	2.7770
7/8	2.0771	2.5439	1.4687	2.7139	1.1241	0.7602	2.8373
6	2.1213	2.5980	1.5000	2.7716	1.1480	0.7764	2.8977
1/8	2.1655	2.6522	1.5312	2.8293	1.1719	0.7926	2.9581
1/4	2.2097	2.7063	1.5625	2.8871	1.1958	0.8088	3.0185
3/8	2.2539	2.7604	1.5937	2.9448	1.2197	0.8249	3.0788
1/2	2.2981	2.8145	1.6250	3.0026	1.2437	0.8411	3.1392
5/8	2.3423	2.8687	1.6562	3.0603	1.2676	0.8573	3.1996
3/4	2.3864	2.9228	1.6875	3.1180	1.2915	0.8735	3.2599
7/8	2.4306	2.9769	1.7187	3.1758	1.3154	0.8896	3.3203
7	2.4748	3.0311	1.7500	3.2335	1.3393	0.9058	3.3807
1/8	2.5190	3.0852	1.7812	3.2913	1.3632	0.9220	3.4410
1/4	2.5632	3.1393	1.8125	3.3490	1.3872	0.9382	3.5014
3/8	2.6074	3.1934	1.8437	3.4068	1.4111	0.9543	3.5618
1/2	2.6516	3.2476	1.8750	3.4645	1.4350	0.9705	3.6222
5/8	2.6958	3.3017	1.9062	3.5222	1.4589	0.9867	3.6825
3/4	2.7400	3.3558	1.9375	3.5800	1.4828	1.0029	3.7429
7/8	2.7842	3.4099	1.9687	3.6377	1.5068	1.0191	3.8033
8	2.8264	3.4641	2.0000	3.6955	1.5307	1.0352	3.8636

National officers of ASTE look over floor plans for the Society's Western Industrial Exposition scheduled to be held at the Shrine Auditorium in Los Angeles from March 14-18, 1955

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ALL chapter visitations by A.S.T.E. officers, directors and national committee chairmen are recorded in special reports to aid other members of the national family in keeping posted on chapter operations. Topics covered include such items as financial status, expansion of membership, special projects and the like. An amusing departure was made recently by Dr. Harry B. Osborn, Jr., ASTE first vice president, in a visitation report for the Benton Harbor-St. Joseph, Mich., chapter. Here it is!

"THIS is a sad story. On Wednesday, October 13, I parked my plane at Detroit City Airport, planning to fly to St. Joseph the following afternoon. I arrived at the airport about 1 p.m. Thursday and learned that some girl in driving to work at the Administration Building had lost control of her car and picked my plane out of some twenty to make history. She did quite a bit of damage to my plane and pushed into the one parked along side of it. She was then so excited she backed up her car and proceeded to park in her usual place—and then probably collapsed in the ladies' room for a couple of hours.

"DURING that time someone noticed the damage, had called the police, and the word hit the A. P. wire service concerning a new type of hit and run driver, one who had run into an airplane and left the scene of the accident. She finally did report it and by the time I got there, everything was under control except, of course, my airplane. The damage wasn't too bad, but it meant I was without a plane. I finally prevailed upon one of the operators at the field to rent me a plane but by the time I got off, I knew I was heading into bad weather and the possibility of running out of daylight. Jackson, Mich., came up on the schedule but Battle Creek and vicinity was covered by a thunder storm extending all the way to South Bend. Upon advice from the radio range stations, I attempted to get around the storm to the south and finally ended up near Fort Wayne.

"THE storm continued for such a length of time that I was even unable to get into South Bend, and finally, with no possibility of landing at St. Joseph after dark, gave it up as a bad job and headed back for Detroit. I got someone to fly me to Willow Run and got a plane to Cleveland from which place I never should have started the day before.

"SO FOR the record, please indicate this was a no-visit visitation."

EDUCATION AWARDS

As one of ASTE's most vital contributions in fostering tool engineering education on the college level, a total of $7,000 in International Education Awards will be presented next year by the American Society of Tool Engineers. Ten awards of $700 each will go to outstanding engineering students in recognized schools in the United States and Canada.

Winners will be announced in March at the 1955 Annual Meeting and Western Industrial Exposition being held at Los Angeles. Members of the National Education Committee, headed by Prof. Robert E. McKee of the University of Michigan, will act as judges. Awards will become effective at the beginning of fall term.

All ASTE members are urged to encourage engineering students in their chapter areas to apply for the education awards. Application forms, which are available at national headquarters, should be submitted to ASTE National Education Committee, 10700 Puritan Ave., Detroit 38, Mich., before March 1, 1955.

To be eligible for awards, students must be taking full-time courses in preparation for future work in tool and production engineering. They must be in the third year of a four-year curriculum, the third or fourth year of a five-year curriculum, or in their last year of study and planning to take post-graduate work.

Participating in the semiannual meeting, clockwise from the left foreground, were: C. M. Smillie, Ben Hazewinkel, H. D. Long, R. A. Smith, R.C.W. Peterson, A. R. Putnam, G. A. Goodwin, H. E. Conrad, J. P. Crosby, H. B. Osborn, Jr., H. C. McMillen, R. F. Waindle, H. E. Collins, A. B. Clark, Wayne Ewing, J. O. Horne, and G. A. Rogers.

ASTE Board Meets in Detroit

By Nancy M. Houston
News Editor

Enthusiastic approval and appreciation of the excellent work being carried out by ASTE's national committees characterized the actions taken by the Board of Directors at its semiannual meeting in Detroit. The two-day session held at the Hotel Statler on October 25-26 was the first meeting of the Board since it was enlarged earlier this year to 15 members.

In reviewing the reports made by chairmen of the committees, the Board voted to extend its "thanks to committee chairmen and entire committees for the wonderful jobs they have done during the year."

National President Joseph P. Crosby, in his preamble to the semiannual reports, said, "I am sure that I am expressing the unanimous opinion of our entire membership for the splendid cooperation of our leaders within ASTE, be they officers, directors, chairmen or committeemen. So many individuals are concerned with the activities of our dynamic organization that it is impossible to distinguish any individuals or groups when expressing the membership's thanks for such a fine performance.

"It is an honest observation, I am sure, that the expansion of our organization and the forward movement toward our objectives is due entirely to

the enthusiasm and the unfailing interest of hundreds, yes, thousands of men, fired with the zeal and ideals of humanitarian achievement."

New Directors Installed

Traditionally, semiannual meetings are concerned mainly with receiving reports of committees and officers, approving budgets for the coming year, and discussing suggestions made at the House of Delegates' meeting. In addition to these considerations, the Board this year also elected another member to the ASTE Research Fund Committee; re-elected the Research Fund chairman for another year; and appointed nominating committees.

These activities were preceded by the installation of five new directors who were elected last April by the House of Delegates. Sworn into office were: Wayne Ewing, A. B. Clark, J. O. Horne, Jr., H. Dale Long, and C. M. Smillie, Jr.

Recognizing the desirability of a man experienced in research, research administration and manufacturing as a member of the ASTE Research Fund Committee, the Board named Gervais W. Trichel, executive vice president of the Amplex Oilite Div. of the Chrysler Corp. to serve on the committee.

Mr. Trichel's experience fits him admirably for helping to plan the research projects of this active group, projects that must be scientifically sound and at the same time must be of real interest and potential value to industry. *(Please turn page)*

President Crosby greets Thomas J. Donovan, Jr., left, former national director of the Society, after a morning session of the Board. At the right is F. J. Sehn, chairman of the National Book Committee.

Chrysler Executive Named to Research Fund Committee

Gervais W. Trichel, elected by the ASTE Board of Directors to serve as a member of the Research Fund Committee, is a graduate of the United States Military Academy (West Point) and received his Ph. D. in physics from the University of California in 1938. He served as an officer in the U. S. Army from 1918 to 1946, at which time he retired at his own request with the rank of Colonel. During his military service he became a recognized authority on fire control instruments in the Ordnance Department. At one time he headed the Fire Control Instrument Research and Development Laboratory at Frankfort Arsenal.

During World War II, he was head of the Rocket Div. of the Office of the Chief of Ordnance in Washington, D. C. Later he served as Chief Ordnance Officer for the Southwest Pacific Theater, with headquarters in Manila. He was decorated with the Legion of Merit for his handling of each of these assignments.

On his retirement in 1946, Mr. Trichel joined Chrysler Corp., where he was in charge of special products planning for several years. He is now executive vice president of Chrysler's Amplex Oil'te Division.

Mr. Trichel adds his experience to that of the present committee members, who are: Robert B. Douglas, chairman, president of Specialloid, Ltd.; Wallace E. Carroll, president of Simpson Electric Co.; Roger E. Gay, president of Bristol Brass Corp.; Ralph J. Kraut, president and general manager of Giddings & Lewis Machine Tool Co.; Dr. William E. Mahin, technical director of Vanadium Corp. of America; Dr. Daniel J. Martin, vice president of engineering of Hughes Tool Co.; Louis Polk, president of Sheffield Corp.; and Joseph Sunnen, president of Sunnen Products Co.

Board Meeting

Robert B. Douglas, president of Specialloid, Ltd., St. Eustache, Que., Canada, was re-elected chairman of the Research Fund Committee. He served as president of ASTE in 1949-50.

Nominating Committees Named

President Crosby named members of the nominating committees for officers and directors with the approval of the Board. Roger F. Waindle, immediate past president of the Society, heads both committees.

During the luncheon breaks, official ASTE business took a back seat to less serious discussions. Shown below at the foreground table, clockwise from the 12 o'clock position, are: Harry E. Conrad, executive secretary; Gerald A. Rogers, Board member; W. W. Schug, Membership chairman; Joseph L. Petz, Editorial chairman; Richard A. Smith and George A. Goodwin, Board member; and Joseph L. Crosby, Board chairman.

Serving with him on the nominating committee for officers are: George A. Goodwin, James Horne, Jr., Charles M. Smillie, and Richard A. Smith. All are national directors.

Named with Mr. Waindle to the nominating committee for directors are: Kenneth W. Riddle, past chairman of the National Program Committee; W. W. Schug, chairman of the National Membership Committee; F. J. Sehn, chairman of the National Book Committee; and Wilfred B. Wells, member of the National Public Relations Committee.

Directors and officers of the Society will be chosen next March at the annual meeting in Los Angeles. Directors will be elected by members of the House of Delegates at their meeting being held at the Hotel Statler on Wednesday, March 16. Officers will be named at the Board meeting scheduled for Thursday, March 17.

At another luncheon table, clockwise from left foreground, are: L. E. Doyle, Professional Engineering chairman; Harold E. Collins, Board member and third vice president; H. Dale Long, Board member and assistant secretary-treasurer; H. B. Osborn, Jr., Board member and first vice president; John X. Ryneska, Constitution and By-Laws chairman; Marvin J. Bunting, national headquarters staff; and Prof. R. E. McKee, Education chairman. Chairmen of ASTE's national committees attend Board meetings to present their reports on committee activities and future plans, and to be on hand to clarify any questions the Board might have regarding special projects and programs.

New ASTE Chapters

Roger F. Waindle, far right, immediate past president of ASTE, swears in officers of the Benton Harbor-St. Joseph chapter, who are: from left, Ivan Peters, secretary; Virgil Ramsey, treasurer; Allen Ashley, first vice chairman; Harold Neuman, second vice chairman; and Elmer Hopf, chairman.

Benton Harbor—St. Joseph

With the chartering of Benton Harbor-St. Joseph chapter on September 20, Michigan has as many chapters as the state of New York. Each now has 11.

The ceremony at Hotel Vincent was emceed by Roger F. Waindle, immediate past president of the Society who presented the new chapter with its charter. Assisting Mr. Waindle were: Thomas C. Barber, chairman of the National Program Committee; and H. Verne Loeppert and Ervin A. Byro, both area captains of the National Membership Committee. Other guests were Joseph Flaugh, mayor of Benton Harbor; and John H. Beck, chairman of the Chicago ASTE chapter.

Guest speaker on the program was Hunter Hughes, editorial director of *Industry and Power*.

Officers of the new chapter are: chairman—Elmer Hopf, sales manager for Covel Manufacturing, Benton Harbor; first vice chairman—Allen Ashley, tool designer for Bendix Aviation Corp., St. Joseph; second vice chairman—Harold J. Neumann, tool designer for Bendix Aviation Corp., St. Joseph; secretary—Ivan Peters, assistant master mechanic at Whirlpool Corp., St. Joseph; and treasurer—Virgil R. Ramsey, tool engineer for Gast Manufacturing Corp., Benton Harbor.

San Antonio

The third ASTE chapter in the state of Texas was chartered on October 13. Ceremonies which made San Antonio chapter an official member of the Society were held at Gunter Hotel in San Antonio.

Harold E. Collins, national third vice president of ASTE, as chartering officer presented the charter on behalf of the Society to newly elected Chairman Edgar F. Measels who is equipment specialist at Kelly Air Force Base in San Antonio.

Other officers of the chapter are: first vice chairman—James A. Metcalf and second vice chairman—Oscar G. Tobias, both equipment specialists at Kelly Air Force Base; secretary—Alton A. Hansen, owner of Swing Machinery & Equipment, San Antonio; and treasurer—Maynard B. Berg, owner of Berg Aeromotive Co. in San Antonio.

Other Texas ASTE officials made various presentations to the 121st chapter. Irving H. Buck of the National Membership Committee presented the chairman's pin; O. H. Traughber, national delegate from the Houston chapter, the membership kit; G. L. Freeman, past chairman of the Houston chapter, the banner; and Jimmie Franklin, chairman of the North Texas chapter, the gavel.

Officers of the San Antonio chapter were installed by Harold E. Collins, left, third vice president. Officers are: E. F. Measels, Jr., chairman; J. A. Metcalf, 1st vice chairman; Oscar Tobias, 2nd vice chairman; A. A. Hansen, secretary; and M. B. Berg, treasurer.

Nominees for election to the 1955-56 Board of Directors were selected by the Annual Nominating Committee. From left: F. J. Schmitt, John X. Ryneska, Miss Sylvia Benesh, who recorded decisions of the committee, L. B. Bellamy, and W. A. Thomas. J. J. Demuth was not present.

Candidates named for Board of Directors

A slate of 25 candidates for election to the Board of Directors has been announced by the Annual Nominating Committee. Voting will take place next March in Los Angeles when the House of Delegates convenes at the annual meeting.

National Delegates, elected by chapters in February, will elect 14 men to serve on the ASTE governing body. Joseph P. Crosby will automatically become the fifteenth member of the new board on the date of his retirement as president of the Society.

In making its selections, the Annual Nominating Committee established a policy that all nominees should have chapter experience and have served the Society on a national level. It was also the committee's decision that geographic location should be considered when selecting nominees but that it was far more important that the qualifications of the nominee for directorship receive first consideration. The complete record of all candidates received careful study.

Serving on the committee were: L. B. Bellamy, chairman and ASTE past president; J. J. Demuth, past president; W. A. Thomas, past national director; F. J. Schmitt, past national director; and John X. Ryneska, chairman of the National Constitution and By-Laws Committee. Their report will be circulated at January chapter meetings.

Additional names can be added to the present list of nominees if 20 or more senior members sign a petition for each proposed candidate. All petitions must be received at national headquarters in Detroit by February 1. For the convenience of TOOL ENGINEER readers, the background of each candidate chosen by the members of the Nominating Committee is presented on the following pages for handy reference.

Incumbent National Officers

As provided in the ASTE Constitution, Joseph P. Crosby, now president of the Society and chairman of the Board of Directors, automatically became a member of the 1955-56 Board.

Harry **B. Osborn, Jr.,** first vice president and an incumbent national director, is serving his fourth term as a member of the Board of Directors. He is technical director of Tocco Division, The Ohio Crankshaft Co., Cleveland, Ohio. A past assistant secretary-treasurer of ASTE, he served two terms as chairman of both the National Membership Committee and the National Public Relations Committee. At the chapter level, he has served in numerous capacities culminating in the chapter chairmanship. He has been a senior member since 1943. A national authority in the field of induction heating, he holds a doctorate in chemical and metallurgical engineering, and is a registered professional engineer.

Joseph P. Crosby

Howard C. McMillen, second vice president and an incumbent national director, is plant manager at Philco Corp., Bedford, Ind. He has served one term as third vice president, two terms as national treasurer and three terms as chairman of the National Finance Committee. A senior member since 1939, he is the charter chairman of the Evansville chapter and also served in chapter offices culminating in chairmanship of Dayton chapter. Mr. McMillen has wide executive experience in the refrigeration industry and is a member of the American Society of Refrigeration Engineers. He holds a bachelor of science degree in mechanical engineering and is a registered professional engineer.

Harold E. Collins, third vice president and an incumbent national director, is manager of the Process Engineering Department of Hughes Tool Co., Houston, Texas. A former national treasurer, he is serving his eighth term on the Board of Directors. A charter member and past chairman of the Houston chapter, he became a senior member in 1939 and has been active in chapter affairs. Mr. Collins has served in an advisory capacity to the Joint Industry Mobilization Group of the Machine Tool Industry and is a member of the Tool Committee of the Army Ordnance Association. An industrial executive and tool engineer, he is active in many other technical societies.

Raymond C. W. Peterson, national treasurer of ASTE, is owner of the Peterson Engineering Co., Toledo, Ohio. A former national secretary, he served two terms as chairman of the National Standards Committee and was secretary of the B-52 Committee of the American Standards Association. Active in chapter affairs since 1945, he is a past chapter chairman and delegate. Mr. Peterson was instrumental in the establishment of the tool engineering course at the University of Toledo. His affiliations include the Pressed Metals Institute, of which he has been a director; the Ohio Society of Professional Engineers and ASME. He holds a bachelor of science degree in mechanical engineering and is a registered professional engineer.

Wayne Ewing, national secretary of ASTE, is president of the Arrowsmith Tool & Die Co., Los Angeles, Calif. A former assistant secretary-treasurer, he has served as vice chairman of the Nation Membership Committee and in most of the Los Angeles chapter offices, including the chairmanship. A member of the Society of Automotive Engineers and the Southern California Tool & Die Association, Mr. Ewing has devoted much of his time to several state and county committees for the education of apprentices in tool engineering.

H. Dale Long, assistant secretary-treasurer and incumbent national director, is president of Scully-Jones & Co., Chicago, Ill. He has served on the Annual Nominating Committee and as chairman of the National Finance Committee. In 1952 he was co-host chairman of the Industrial Exposition and chairman of the House of Delegates that same year. Mr. Long has been chairman of the Chicago chapter and held several other chapter offices. He is active in a number of civic organizations. He is a graduate of the University of Illinois.

H. B. Osborn

H. C. McMillen

H. E. Collins

R.C.W. Peterson

Wayne Ewing

H. D. Long

Incumbent National Directors


A. B. Clark


W. G. Ehrhardt


G. A. Goodwin


J. O. Horne


C. M. Smillie


R. A. Smith

Andrew B. Clark, serving his first term on the Board of Directors, has been technical consultant with Haynes Stellite Co., a unit of Union Carbide and Carbon Corp., Cleveland, Ohio, for the past 36 years. He has served successively on the National Public Relations Committee, National Program Committee, and the National Membership Committee, which he headed as chairman for three years. Since becoming a senior member in 1942, he has held numerous chapter positions, including the chairmanship. Mr. Clark is a former faculty member at the University of Akron and was a teaching specialist for the War Manpower Commission of the War Production Board.

Willis G. Ehrhardt is serving his third term on the Board of Directors. He is managing partner of Ehrhardt Tool and Machinery Co., St. Louis, Mo. Past chairman of the National Public Relations Committee, he is also a former member of the National Membership and Program Committees. He became a senior member in 1938 and has held a number of chapter posts, including the chapter chairmanship. Mr. Ehrhardt is past president of the National Tool and Die Manufacturers Association and has had long experience in the tool and die field. A registered professional engineer, he is a member of ASM and also active in other technical organizations.

James O. Horne, serving his first term as a member of the Board of Directors, is owner of the J. O. Horne Co. in Rochester, N. Y. He was a member of the National Program Committee from 1947 to 1953, serving as committee chairman in 1952-53. A senior member of the Rochester chapter since 1940, he is a past chairman and has held numerous other chapter offices. He is a member of the Chamber of Commerce.

George A. Goodwin, chief process engineer, The Master Electric Co., Dayton, Ohio, is serving his fifth term as a national director. Former member and past chairman of the National Finance Committee, he was national treasurer for a period of three terms. He is a charter member of the Dayton chapter which he served as first vice chairman and chapter chairman. Mr. Goodwin has held various engineering positions since 1910 and is a registered professional engineer. He is a member of the Advisory Council on Tool Engineering of Sinclair College and is active in a number of professional organizations.

Charles M. Smillie, president of the C. M. Smillie Co., Detroit, Mich., is serving his first term as a member of the Board of Directors. He is past chairman of the National Professional Engineering Committee and also served two years on the National Membership Committee. A senior member of the Detroit chapter since 1940, he has held various chapter offices including the chairmanship. Currently Mr. Smillie is national director of the National Screw Machine Products Association and state chairman of the Advisory Council of Scientists and Engineers of the Selective Service System. He holds a degree in mechanical engineering and is a registered professional engineer.

Richard A. Smith is serving his second term as a national director for the Society. He is chief tool engineer at Pratt and Whitney Division, Niles-Bement-Pond Co., West Hartford, Conn. A former member of the Annual Nominating Committee, he is author of Section 12 of the ASTE *Tool Engineers Handbook*. He has been a senior member since 1936 and has served the Hartford chapter in numerous capacities including that of chapter chairman.

Additional Nominees

Thomas C. Barber is president and owner of Tool Service for Industry, Chicago, Ill. A member of the National Program Committee since 1951, he is currently serving as chairman of the group. He held the post of chairman of the host committee for the 1952 Annual Meeting and Industrial Exposition. On the chapter level, Mr. Barber has held numerous offices culminating in the chairmanship.

Gustave B. Berlien is a partner in Industrial Steel Treating Co., Oakland, Calif. He served on the 1953 Annual Nominating Committee of ASTE and is now a member of the National Editorial Committtee. As a chaper officer he has held numerous positions including the chairmanship. He is a member of ASM, Metal Treating Institute, American Society of Refrigeration Engineers, and is active in several civic organizations.

George F. Bryan is supervisor of tool design at the GMC Truck and Coach Division of General Motors Corp. A member of the National Standards Committee since 1952, he is now serving as chairman of the group. He has been active in Pontiac chapter affairs since 1945 and has held several offices, including the chairmanship.

Irving H. Buck is president of the Tool Supply & Engineering Co., Dallas, Texas. A senior member since 1942 and a charter member of the North Texas chapter, he is completing his third term on the National Membership Committee. Mr. Buck served in a number of chapter capacities, including three terms as chapter chairman. He is a member of the Dallas Engineers Club, Chamber of Commerce and is on the board of directors of Great Southwest Life Insurance Co.

Arthur R. Diamond is vice president of Tools, Inc., Philadelphia, Pa. Immediate past chairman of the National Education Committee, he was an active member of the committee since 1948. He has held numerous chapter posts and as chapter delegate in 1950 was chairman of the House of Delegates. Mr. Diamond is a member of ASME, Society of American Military Engineers, and ASM, and is active in a number of civic organizations. He holds a master of science degree in mechanical engineering and is a registered professional engineer.

John W. Lengbridge is project engineer at Aluminum Goods, Ltd., Toronto, Ontario, Canada. He is a member of ASTE's National Professional Engineering Committee. As a charter member of the Toronto chapter, he has served as education chairman from 1942 to 1954. He held other chapter offices as well, including the chairmanship. Active in numerous civic groups and organizations, he holds membership in the Association of Professional Engineers in the Province of Ontario, ASME, ASM, and the British Institute of Metals. Mr. Lengbridge has written numerous technical articles for metalworking publications and has toured the United States and Canada as a lecturer for ASTE and ASM meetings. He is a registered professional engineer.

William Moreland is assistant works manager at Greenlee Brothers & Co., Rockford, Ill. A member of the National Standards Committee since 1945, he is now serving as vice chairman of the group. At the chapter level he has held numerous executive posts of the Rockford and Detroit chapters, culminating in the chairmanship for Rockford in 1953 and is now their national delegate for the second time. He is a member of technical committee number seven on twist drills for the American Standards Association and of that organization's Mechanical Standards Board. He is a member of the Rockford Chamber of Commerce.

Joseph L. Petz is secretary-treasurer of Petz-Emery, Inc., Poughkeepsie, N. Y. He is completing his fifth term as a member of the National Editorial Committee and his second as committee chairman. Active in Mid-Hudson chapter affairs, he has served as chapter chairman and in a number of other capacities. In the field of tool engineering education, Mr. Petz has taught tool design as an outside activity for 12 years. He is a member of the American Society for Metals.

Frederick Preator is professor and head of the tool engineering department at Utah State Agricultural College, Logan, Utah. A member of the National Education Committee since 1950, he formulated the curriculum in tool engineering given at Utah State, the only college in the country offering a degree in the subject. He also wrote a brochure on "A Career for You in Tool Engineering" for ASTE. Prof. Preator's industrial experience covers more than 16 years and includes eight years as master mechanic for two radio manufacturing companies. Listed in "Who's Who in the West," he is a member of several technical and honorary societies and is active in several civic organizations. He attended Birmingham Technical School in Great Britain and is a member of the Institution of Production Engineers. He holds a bachelor of science degree from Utah State College and a master's degree from Wayne University.

John E. Rotchford is chairman of the Data Sheet Subcommittee of the National Standards Commitee. He has been a member of ASTE's Sandards Committee since 1953. At the chapter level Mr. Rotchford has held several offices and is past chairman and national delegate of the Worcester chapter. He also holds membership in the American Ordnance Association and the New England Quartermaster Association.

Edward H. Ruder is vice president of Blackman & Nuetzel Machinery Co., Kansas City, Mo. A member of the Society since 1937 he is currently serving his second term as chairman of the National Public Relations Committee. Previously Mr. Ruder was chairman of the National Constitution and By-Laws Committee for a term, and one of its members for three years. Active in St. Louis chapter affairs, he has held several offices including the chairmanship. He is a member of the Engineers Club of St. Louis, the American Ordnance Association, and is a registered professional engineer.

William A. Thomas, who has served the Society in a number of national posts, is superintendent of manufacturing and engineering at the machine shop and stamping plant of the Ford Motor Co. of Canada, Ltd., Windsor, Ont. Now a member of the Annual Nominating Committee, he has also held the positions of national secretary and assistant secretary-treasurer, and was a member of the National Standards Committee for four terms. On the chapter level, Mr. Thomas was elected to several offices, including the chairmanship. He served three terms as chairman of the Canadian Standards Subcommittee and one term as chairman of the Canadian Data Sheet Subcommittee when those groups were active.


A. R. Diamond


J. W. Lengbridge


Wm. Moreland


J. L. Petz


F. Preator


J. E. Rotchford


T. C. Barber


G. B. Berlien


G. F. Bryan


I. H. Buck


E. H. Ruder


W. A. Thomas

STUDENT chapters

By Edith R. Saunders
Assistant News Editor

Donovan Hill, chairman of the University of Kansas chapter, accepts the permanent charter from Harold Buddenbohm, chairman of the Kansas City chapter.

Officers of the University of Michigan student chapter are: seated from left, Jay Vandersluis, treasurer; Don Graham, secretary; Douglas Taylor, second vice chairman; Irving Stewart, first vice chairman; and Lou Dame, chairman. Standing are: Kenneth Ludema, program chairman; Philip Visser, faculty advisor; Prof. Robert McKee, chairman of the National Education Committee; and Charles M. Smillie, member of the National Board of Directors.

Three student chapters officially joined Society ranks this fall. Permanent charters were granted to student groups at the University of Michigan, Utah State Agricultural College and the University of Kansas.

University of Michigan formerly operated on a temporary charter. On September 23, Robert E. McKee, chairman of the National Education Committee and associate professor of production engineering at the university, presented the charter.

A special guest of the student chapter No. 1 was Charles M. Smillie, national director of ASTE, who talked on "Maximum Use of Your Assets." Prof. O. W. Boston reminisced on chapter history.

Student chapter No. 2, at Utah State Agricultural College received its charter at a meeting held October 15 on campus at the Student Union Building, Logan, Utah.

Participating in the program were: Wayne Ewing, national secretary of ASTE; Dean J. E. Christiansen; and Prof. Frederick Preator of the National Education Committee and head of the school's tool engineering department; and Prof.

Lou Dame, left, chairman of the University of Michigan student chapter, receives the permanent charter from Prof. Robert McKee who is currently chairman of the National Education Committee and an associate professor of production engineering.

Head table guests at the Utah State Agricultural College ceremonies for chartering were: from left, Dean J. E. Christiansen; Wayne Ewing, national secretary of ASTE; and Frederick Preator, of the National Education Committee.

Utah State officers were sworn in by Wayne Ewing, far right, national ASTE secretary. They are: from left, Jay Bills, treasurer; Darrell Davis, secretary; Deon Van Cleave, second vice chairman; L. R. Martin, first vice chairman; and Floyd Veibell, chairman of the student group.

Donovan Hill, University of Kansas chairman, proudly displays the chapter's permanent charter. From left, are: Prof. Howard O. Rust, faculty advisor; Charles Wright, treasurer; Ronald Hill, secretary; Mr. Hill; Richard Staadt, second vice chairman; and Joseph Breazeal, first vice chairman.

Rawson D. Child, faculty advisor for the group.

Guest technical speaker was Roger Keough, field engineer at Scully-Jones and Company, Chicago.

Official chartering ceremonies for the University of Kansas organization were held October 15 at the Fowler Shops on the campus at Lawrence, Kansas.

Donovan Hill, chairman of the chapter, accepted the charter from Harold Buddenbohm, chairman of the Kansas City chapter. Mr. Buddenbohm, who is also a past chairman of the university chapter, installed the officers who will guide 1954-55 activities.

Participating in the program were Amber Brunson, Ward Osborn and Jack Merrick, all past chairmen of the Kansas City chapter.

Special recognition was given Prof. Paul G. Hausman, chairman of the engineering shop practice department, for his efforts in getting the chapter organized at the college.

How to Form a Student Chapter

To aid university and college groups which would like to establish ASTE student chapters on their campuses, here is a brief summary of student activities and requirements approved by the Society's Board of Directors at the 1954 Annual Meeting.

Programs of student chapters follow the same pattern set up by other chapters of the Society. Plant tours, technical lectures and panel discussions offer opportunities for student engineers to see manufacturing facilities in industrial firms and to hear authorities in the many fields related to tool engineering.

Another important phase of student meetings is the exchange of ideas and the chance to become better acquainted with engineering instructors and professors.

Student members also receive monthly issues of THE TOOL ENGINEER, official publication of ASTE which contains the latest technical information on tool engineering and also news of what other Society chapters are doing.

The student chapter represents a professional society on the campus through which ASTE students, with common interests in production tool engineering, can meet and arrange technical meetings, seminars, and social activities. This furnishes a desirable activity for students, which supplements their technical training with opportunities for personal, social and organizational leadership.

Charters can be granted to student groups at institutions approved by the Engineers' Council for Professional Development. A minimum of 15 students taking full-time courses in tool engineering (or related fields) must be signed up to become charter members. Voting privileges on the chapter level are extended to all student members. However, they do not participate in national balloting. No initiation fee is charged and yearly ASTE dues are cut to $3.

Student groups interested in becoming ASTE chapters can obtain more detailed information by writing to the National Education Committee, ASTE National Headquarters, 10700 Puritan Ave., Detroit 38, Mich.

Illinois and Wisconsin

On-Campus Conferences

At the opening session of the Illinois conference, Dean Charles C. Cavney, left, of the University of Illinois, welcomes: Howard C. McMillen, ASTE second vice president; H. Dale Long, assistant secretary-treasurer; and Dr. Halden Leedy, director of Armour Research Foundation. All were participants in a panel discussion on "Management's Opportunities for Cost Reduction."

Dr. H. B. Osborn, Jr., standing, addresses the luncheon session held at Navy Pier. With him, from left, are: Dr. Donald H. Loughridge, dean of the Technological Institute at Northwestern University; and J. H. Beck, chairman of the Chicago ASTE chapter.

Speakers at other technical session in Chicago included, from left: H. D. Hiatt, Allison Div., General Motors Corp.; L. E. Doyle, associate professor of mechanical engineering at the University of Illinois; Clare Bryan, Foote Bros. Gear & Machine Corp.; J. S. Kozacka, professor of mechanical engineering at U of I; H. W. Highriter, vice president and technical director, Vascoloy-Ramet Corp.; K. J. Trigger, professor of mechanical engineering at U of I; Dr. Merhyle F. Spotts, professor of mechanical engineering, Northwestern University; and S. A. Brandenburg, vice president, Monarch Machine Tool Co.

The University of Wisconsin program offered a tour of the Madison Kipp Corp. Among the visitors were: J. Rudat, L. Gresk, C. Seaver, R. C. W. Peterson, ASTE national treasurer, H. Bramley and C. Chapman.

Another tour group included: A. Hessel, J. Piekarski, R. Roth, L. Peck, R. Lang, W. Pankonin and R. Rosenmerkel. The plant visitation was part of a three-day schedule of activities held October 20-22. A dinner meeting sponsored by the Madison chapter was the concluding event.

Upper—Principal speaker at the dinner session was T. B. Worth, right, of the Birmingham College of Technology in England. Checking program notes with him is W. O. Moeser of Jones and Lamson Machine Co. Lower—From left are shown: S. A. Brandenburg, vice president of Monarch Machine Tool Co.; J. J. Jaeger, chief engineer, Keller Div., Niles-Bement-Pond; and Carl Oxford, member of ASTE's National Education Committee.

Women's Activities Planned

ASTE wives who accompany their husbands to the 1955 Los Angeles Exposition next March, can look forward to a varied and interesting program of sightseeing and social functions appealing to a wide range of tastes.

Making certain that the women will find the visit a memorable one is the chief goal of the Women's Activities Committee, headed by Mrs. Wayne Ewing, wife of ASTE's national secretary.

With the added advantage of feminine viewpoint, the committee is planning such activities as shopping trips, visits to radio and television programs and art galleries, a movie studio tour and luncheons.

Since a great many convention-goers will be arriving on Monday, the first day of the Exposition, no tours have been scheduled. This will allow the wives to unpack, find their bearings and get settled in their hotel rooms. However, a get-acquainted tea has been planned for Monday afternoon at the Ambassador Hotel and all the wives are invited.

Activities get in full swing on Tuesday with two tours planned. One group will visit Forest Lawn cemetery, eat lunch at Pasadena's Bullock's, and go on to tour Huntington Library and Art Gallery.

The alternative tour for Tuesday is a trip to Knott's Berry Farm, famous for its Ghost Town and other replicas of the old West.

Wednesday's tours will offer a choice between a trip to renowned Farmers' Market or a tour of Columbia Picture Studio with lunch in the commissary.

Thursday will wind up activities for the gals who can elect to go either to the Oceanarium and Palos Verdes or to "Queen for a Day" and other TV programs. The women will be returned to their hotels in plenty of time to join their husbands for the 23rd Annual Banquet to be held in the Cocoanut Grove of the Ambassador Hotel that night.

At an early fall meeting of the Women's Activities Committee, husbands, all members of the Los Angeles Host Chapter Committee, joined their wives at the Ambassador Hotel to coordinate 1955 Exposition program plans. Husbands are: from left, Paul Slater; Ben Hazewinkel, national director of ASTE; Eddie Riddle; Wayne Ewing, national secretary of ASTE; Ralph Chrissie, a member of the National Membership Committee; Tom Gibson; and Frank Balé. Committeewomen are: Mesdames Slater; Hazewinkel; Balé; Ewing, chairman; Gibson; Chrissie; and Riddle. Unavoidably absent were Carl Almquist and his wife.

Fort Wayne Welcomes New ASTE Members

At a meeting held October 13 at the Chamber of Commerce, the Fort Wayne chapter welcomed new members to the ASTE ranks. As announced by Alfred E. Peterson, chairman of the membership committee, they are: John S. Rehrer, Donal R. Batchelder and Earl A. Riley, Jr. Transferred members include: Donald E. Hill, Kenneth E. Jasper and Edwin M. Pearne. All were welcomed by Chairman Charles A. Haugk.

Coffee speaker at the session was Halsey Owen, professor of manufacturing processes at Purdue University. He talked on the importance of professional engineering registration and how it affects the tool engineer.

Technical speaker was S. E. Flenner, general sales manager for the Alloy Precision Casting Co., Cleveland, Ohio. His topic was "Mercasting—How and Why," which covered the use of frozen mercury for making cores.

A chapter officer and a former chapter chairman at Fort Wayne are now in new engineering positions. Past Chairman Everett Keese has joined the planning section of the small integral motor department at General Electric Co., and Charles Haugk, the current chairman, is associated with the Crosby Aeromarine Co., Inc.

Roland Hille, chairman of the constitution and by-laws committee, has been appointed to represent ASTE on the committee for the observance of engineering week in Fort Wayne.

—Robert H. Bienz

Technical Director Talks at Springfield, Ill.

About 65 members of the Springfield, Ill., chapter met October 5 at The Mill to hear a talk by R. B. Saltonstall on "Electroplating in Industry." Mr. Saltonstall is technical director of the Udylite Corp., Detroit, Mich. He discussed the theory and practice of electroplating, paying particular attention to phases of hard chromium plating of small tools.

An excellent film showing the Udylite plating equipment in operation was shown during the program.

On September 14 the chapter heard a talk by Melvin G. Sulser of Denison Engineering Co., Columbus, O. He spoke on the Hydraulic Multipress and automation as an index to profits. Examples were shown of indexing tables used with Denison Multipresses for riveting, staking and assembly of different types of products.

—Charles Collier

These ASTE members were among the 150 who visited the Grumman Aircraft Engineering Corp., Bethpage, Long Island, on Saturday, October 16. Long Island chapter was host to Lehigh Valley members for the day's activities. From left: Charles Richards; Werner O. Miller, George J. McLaughlin, George W. Savitz, John C. Hatter, Sara T. Moxley, and William J. Lamberta.

Two Speakers Highlight Mid-Hudson Program

When the members of Mid-Hudson chapter met October 12 at Nelson House, two speakers were on the program agenda. The 85 in attendance heard Dr. Neal Bowman of the National Association of Manufacturers. The title of his talk was Changes and Challenges."

Dr. Bowman was optimistic about industry's future and said that by 1975 U. S. industry will have employed 20 million more men. He also spoke of the challenge to Americans—that of selling their way of life. Communists, he said, work at its 24 hours a day, whereas, Americans who have enjoyed their freedoms for generations, have become complacent.

Coffee speaker was D. C. Cunningham, district manager of Kennametal in Poughkeepsie. He showed a film by Kennametal on railroads and machining.

—Davis Gale

Schenectady Hears GE Representative

A discussion of "Plastics, Parts and Mold Design" was presented at the October 11 meeting of the Schenectady chapter. The session was held at the American Legion Home. Speaker was C. A. Sundstrom, mold cost estimator for the General Electric Co., Taunton, Mass.

Mr. Sundstrom defined the types of plastics, described how they are manufactured and told of their many applications. He also covered the characteristics of many plastic products, reviewing the advantages and disadvantages of each.

—George S. Nelson

Oscar Demuth Dies After Brief Illness

Charter member of the St. Louis chapter and brother of J. J. Demuth past president of the Society, Oscar F. Demuth, 56, died in a St. Louis hospital on September 24. He had been hospitalized for four months. At the time of his death he was associated with the Ehrhardt Tool & Machine Co. as superintendent, a position he had held since 1939 when he joined the firm. The company's president, Willis G. Ehrhardt, who is a national director of ASTE, and Mr. Demuth had been associated in business together for the past 30 years. Upon joining ASTE early in 1938, Mr. Demuth devoted much of his time to Society activities and was counted as one of the most loyal supporters of the St. Louis chapter.

Oscar Demuth

North Texas Members Hear Alford Sparrow

"Automatic Screw Machines and Their Applications" was the topic chosen by Alford R. Sparrow who spoke before the October 8 meeting of the North Texas chapter. Mr. Sparrow, supervisor of design, Brown and Sharpe Manufacturing Co., drew a capacity crowd which filled the dining room at the Amon Carter International Airport for the first regular meeting of the season.

—R. E. McMahan

Hartford Night

By A. Douglas Proctor
Editorial Chairman

Grant W. Smedley
Public Relations Chairman

Enjoying Hartford Night festivities are: from left, Robert L. Gay, chairman of the Hartford chapter; Joseph P. Crosby, national ASTE president; and Ray H. Morris, past national ASTE president who served as toastmaster.

An overflow crowd of more than 600 persons helped make Hartford Night, held October 11 at the Hotel Statler, an outstanding success. ASTE members and friends attending the annual event heard an inspiring address made by National President Joseph P. Crosby and an informative technical speech by Jacob J. Jaeger, chief engineer of the Machinery Div. of Pratt & Whitney, Niles-Bement-Pond Co.

Toastmaster for the program was Ray H. Morris, past president of ASTE and former chairman of the Hartford chapter. Arrangements were made by Robert L. Gay, chairman, and a committee of chapter officers and members.

In addition to Mr. Morris, other past chairmen present at Hartford Night were: I. F. Holland, Jarry J. Houck, Carl Moeller, Henry Rockwell, George A. Highberg, Edward Morency, Richard A. Smith, William Jarvis, Clayton S. Parson, Robert M. Toppin, Henry E. Kuryla, and Omer A. Gingras.

The guest list included leading industrialists and manufactures from Hartford County. Invitations were also extended to neighboring ASTE chapters.

Representing Little Rhody, Greater New York, Fairfield County and New Haven were: Wolfer Pender, Gordon Smithson, Tony Ward, Edward Berry, S. G. Froger, J. Schoer, H. L. Strauss, Jr., Henry Schiff, M. Milton Tanenbaum, and Jean Nazeley, C. Horwath, D. Cassadas, G. Norick, W. Elliott, Eugene Laistner, Edward Mayberry, A. E. Murray, F. Minillo, Phil Marcellius, John Brozek, John Meehan, Harry Bill, Jr., and Manning Lull.

In his address, Mr. Crosby described technical advancement of tool engineers from the time of Ben Franklin and Eli Whitney up to the present day. He em-

Special guests at Hartford Night in the Statler Hotel include: from left, W. P. Knaus of Manufacturers Association of Hartford; P. J. Sullivan, vice president of Arrow-Hart & Hegeman Co.; W. R. Morse, executive vice president of The Stanley Works; Charles P. Goss, president of Goss & DeLeeuw Co.; and A. F. Kacynzki, Manufacturers Association of Conn.

phasized the importance of ASTE in the exchange of ideas and methods at chapter meetings and technical sessions.

"By taking an active part in local ASTE chapters the tool engineer of today enhances his own personal opportunity for advancement," he said. "Participation on committees brings him in touch with men in all branches of engineering who are experts in their fields.

"By becoming active in the administrative duties of the Society, he sees firsthand how the cooperation between officers and members provides a smooth, well-running organization of genuine service to the industrial interest of his area. Knowledge of management technique is a welcome addition to technical know-how."

Concluding his talk, Mr. Crosby stated that the letters in ASTE, in addition to standing for the American Society of Tool Engineers, also represent the things our Society exemplifies.... the American Spirit of Technical Enterprise.

"Pros and Cons of Automation" was the topic of technical speaker Jacob J. Jaeger. His presentation covered developments from the belt-driven era up to the modern concepts of automation.

Describing some of the necessary planning vital in making automation successful, Mr. Jaeger said, "We do not move toward complexity for the sake of technical or academic accomplishment, using this as a substitute for good machine design. Good designs are those that make money for the builder and user alike."

As souvenirs of the Hartford Night program, all those attending the event were given Stanley 'push-pull rules' in appreciation of their support of the event.

U. S. Tool Co. Engineer Speaks at Milwaukee

More than 125 Milwaukee members and guests attended the October 14 meeting held at the American-Serbian Memorial Hall. The technical program, presented by A. Melnick, chief tool engineer at U. S. Tool Co. in New Jersey, covered the topic "Multi-Slide Machines and Die Operation."

Mr. Melnick demonstrated, with the aid of slides, the Multi-Slide Machine and feeding and straightening devices. Complicated formed pieces, shown in each stage of their forming operation, were shown and explained.

A film in slow motion gave a clear picture of the function and operation of the machine. Questions asked by the members proved their interest in the discussion. —*Walter Behrend*

This seems to be the vice presidents' corner. Four who were at Hartford Night are: from left, James H. Skinner, vice president of Skinner Chuck Co.; W. R. Morse, executive vice president of The Stanley Works; P. J. Sullivan, vice president of Arrow-Hart & Hegeman Co.; and Bret C. Neece, vice president of Landers, Frary & Clark Co.

Two Technical Programs Featured at Racine

A film entitled "Tracer Control in Action," produced for the George Gorton Machine Co., Racine, and a talk on atomic energy given by a manager for Firth Sterling, Inc., were featured attractions at Racine's October meeting. Introduced by Harlow Klema, sales manager at Groton, the film is brand-new and had its first showing at this meeting. Its subject material dealt with tracers on die sinking machines. The discussion on atomic energy was given by Malcolm E. Judkins, who is manager of the New Products Division of Firth-Sterling, Inc., Pittsburgh, Penn. His talk covered the different types of bombs utilizing atomic energy and also the new power developments designed for civilian use. The tremendous interest in his topic was evidenced by the enthusiastic question and answer period. —*Alvin J. Michna*

Harlow Klema

Elected Vice President

Harry H. Rose, general manager of the Simmons Fastener Corp. of Albany, N. Y., has been elected vice president and director, according to an announcement by Charles A. Simmons, Sr., president. Mr. Rose, a member of the Hendrick Hudson ASTE chapter, will continue as general manager, a position he has held since 1949 when he was promoted from general sales manager.

Professional Engineers Discussed at Calumet

At their meeting October 20, members of the Calumet Area chapter heard a coffee talk on registration of professional engineers and a discussion on the practical aspects of heat treatment of steel.

Technical speaker was E. J. Pavesic of Lindberg Steel Treating Co., Chicago, Ill. Utilizing slides in his presentation, Mr. Pavesic covered the necessity of using steel of uniform chemistry, normalizing it when necessary, and the removal of surface defects. He also emphasized the importance of proper design to eliminate stress risers.

The coffee talk was given by Prof. Solberg, head of the mechanical engineering department at the University of Indiana. —*L. W. Montgomery*

A. B. Albrecht Addresses Springfield, O., Chapter

"Industrial Approach to Practical Machining" was the subject discussed October 12 by A. B. Albrecht at a meeting of the Springfield, Ohio, chapter. Mr. Albrecht is development engineer with the Monarch Machine and Tool Co., Sidney, O.

Demonstrations were given on Monarch test lathes equipped with dynamometers, showing actual tool cutting pressures resulting in the proper balance of speeds and feeds. The Monarch Air Gauge Tracer controlled turning machines were also demonstrated showing the low tooling costs, high production rates and extreme accuracy. —*Roger Horstman*

Two of R. G. Van Keuren's visits to western chapters are recorded by the above pictures. At the left, Seymour Jacobson; right, chairman of the Tucson chapter thanks him for his informative talk. In the right-hand picture, from left, L. Dean Roulund, chairman of the Golden Gate chapter; Mr. Van Keuren; and Vern Gallichotte discuss the success of the technical program. Mr. Van Keuren's talk at all of the chapters was "What's New in Grinding."

Robert Van Keuren Addresses Nine Western Chapters During October

Nine western chapters were included in a tour during the month of October by Robert G. Van Keuren, manager of sales engineering, Abrasive Division, of the Norton Co., Worcester, Mass. Mr. Van Keuren's program, "What's New in Grinding," was presented at Golden Gate, Long Beach, Los Angeles, Phoenix, San Diego, San Fernando Valley, San Gabriel Valley, Santa Clara Valley and Tucson chapters.

The tour was organized by Jim Matthews of the Tucson chapter in cooperation with the National Program Committee.

Mr. Van Keuren, a frequent speaker before technical groups and societies, is a member of the Worcester chapter. His program before the chapters included illustrated discussions on grinding fluids, a new concept of grinding, proper use of diamond wheels and electrolytically assisted carbide grinding.

Golden Gate

Further news from Golden Gate's same meeting reported by Ernest H. Romine, chapter editorial chairman, states that many special guests were on hand for the event. Coffee speaker was Dr. L. H. Cook who gave a talk on his visit behind the Iron Curtain, while attending the European tool convention.

Other guests were: Ralph Chrissie of the National Program Committee; six past chairmen of the Golden Gate chapter, including Ed Raves, Carl Bues, Harold Wolpman, Ben Berlien—now a member of the National Editorial Committee; Ted Rohr, and D. A. Gustafson.

Still other distinguished guests were: Arthur Bergen of Bergen Machinery Co. in Inglewood, Calif., who is author of the broaching section in the ASTE Handbook; Mr. Hibbs, vice president and general manager of the Norton Co.'s Machine Division; and Norman Ekholm, abrasive engineer for Norton's West Coast Abrasive Division.

Long Beach

In his report, C. W. Ward, editorial chairman of Long Beach chapter, stated that even though the subject matter was "old stuff," the excellent manner in which Mr. Van Keuren presented it made it like a new subject. Some 65 members heard the talk at the Lafayette Hotel.

John A. Boetteenbach, editorial chairman of the Los Angeles chapter, reports that after the technical portion of the program, members saw a color sound film of the 1954 Indianapolis race.

A. J. Soares, editorial chairman of the San Fernando Valley chapter, reports that 130 members attended their meeting at Hody's Restaurant in North Hollywood. A lively and educational discussion period followed.

According to the report submitted by Joe S. Wajdik, editorial chairman of the San Gabriel chapter, 135 members attended the meeting. Winners of door prizes were: A. Musten, Wes Patten, W. T. Hewson, and J. McWither. A free dinner was also awarded to Al O' Ragsdale.

Santa Clara Valley's report by Bud Weaver, editorial chairman, named members who were elected to the 1955 nominating committee. They are: William Lanyon, Howard Holt and John Lease. Dr. L. H. Cook also was on hand to tell of his adventure behind the Iron Curtain.

Tucson

Joseph W. Vincent, editorial chairman of the Tucson chapter also lists special guests at their meeting. Among them were: William Obitz of Long Island chapter; Steven Birchak of Lehigh Valley chapter; Ray Charters of Douglas Aircraft in Tucson; James Longnaker and Rex Henzie both of Ducommun Metals & Supply Co., Tucson; Ashley Nutt of Industrial Tool and Supply Co., Tucson; and Richard Hoover of Complete Industrial Supply, Tucson.

Roger Keough Is Albuquerque Speaker

A talk on precision toolholding fixtures was presented at the October 12 meeting of the Albuquerque chapter. Technical speaker was Roger Keough, field representative for Scully-Jones & Co., Chicago, Ill. He gave an interesting discussion of "roll-lock" chucks and mandrels as well as fixtures for automatic precision drilling, reaming and tapping. Slides were shown.

—H. E. Anderson

New Affiliation

R. R. Grenfell of the Dayton chapter, formerly field engineer with Sheffield Corp. of Dayton, has recently joined the staff of Norma-Hoffmann Bearings Corp. of Stamford, Conn. He joins the bearing corporation in the same capacity, as a field engineer. Previously he had been chief tool engineer at Norma-Hoffman.

Student Members Meet at University of Kansas

"Residual Stress in Metals" was the program topic for the first technical meeting held by the student chapter at the University of Kansas since its charter night the previous month. Featured speaker was W. G. Johnson; supervising engineer in charge of all engine design and development for the Caterpillar Tractor Co., Peoria, Ill. Slides were used for illustrative material during the talk. About 50 members and visitors attended the event. —*Kenneth Crabtree*

AMTDA PRESIDENCY CHANGES HANDS—Thomas R. Rudel, left, retiring president of the American Machine Tool Distributors' Association, receives an inscribed gavel from his successor, Raymond A. Vidinghoff. At right is James C. Kelley, new general manager of the Association. Mr. Vidinghoff is a member of the Philadelphia chapter and Mr. Rudel is a member of the Greater New York chapter.

New Haven Chapter Visits Die Cast Plant

The New Haven chapter opened its fall season with a visit to New England Die Casting Co. in West Haven, Conn. Approximately 130 members and guests had buffet lunch, compliments of the company, and then toured plant facilities.

They viewed operations from the engineering design stage through building of die cast dies, manufacture of die castings, and the trimming of die castings and machining.

Charles Ohse, president of the company and member of the New Haven chapter, was host and speaker of the evening. He discussed various applications of die casting.

Mr. Ohse's company was awarded a certificate from the Foreign Operations Administration of the United States Government for its part in furnishing technical assistance and operating techniques to other countries.

—*Silas W. Becroft*

John A. Werner Talks to Syracuse Members

The Hiawatha Room of Hotel Onondaga was scene of the Syracuse chapter's October 12 meeting at which John A. Werner was the guest speaker. Mr. Werner is sales engineer in the Industrial Products Department of S. C. Johnson & Son, Inc.

The program, entitled "The Wax Story," dealt with the origin of wax coolants, and was highlighted by a film showing coolants under actual working conditions. Fifty-three attended the meeting. —*Andrew A. Lachner*

Officers of the New Haven chapter view operations at the New England Die Casting Co. during a plant visitation. From left, are: Russell Applegate, treasurer; Robert Burgess, technical chairman; Speaker Charles Ohse, senior member of New Haven chapter and president of New England Die Casting Co.; John Brozek, chairman; and Frank W. Gilbert, chapter program chairman.

Ready Tool Co. President Speaks at Cincinnati

"Engineered Center Hole Designs Control Accuracy" was the subject covered by Carl B. Christensen, president of the Ready Tool Co., Bridgeport, Conn., when he spoke at Cincinnati's September meeting. More than 110 members and friends were present at the Engineering Society for the opening session of the season.

Mr. Christensen emphasized the fact that opposing center holes in workpieces are frequently out of parallel adjustment with the axis or with each other, causing an out-of-round condition to be generated on the workpiece when rotated on dead centers. His solution to close tolerance outside diameter grinding is the use of preloaded ball-bearing live centers. He also explained the formulas used for arriving at the correct diameter of center hole to be used for any given workpiece weight. —*Frank Houston*

W. D. Poling Presents Nashville Program

"Testing of Supersonic Missile Models" was discussed by W. D. Poling of the Arnold Engineering Development Center at Nashville chapter's October meeting. The talk consisted primarily of a description of the gas dynamics facility at the AEDC, the types of tests which will be carried out and the methods of conducting such tests. Colored slides were used to illustrate the lecture. —*Harry Collins*

Two Companies Host to Members of Lima Chapter

Stamco, Inc. of New Bremen, Ohio, and Minster Machine Co. of Minster, Ohio, were joint hosts of the Lima chapter on October 21. Some 140 members and guests were in attendance to hear the welcome address by A. Herkenhoff, president of Minster Machine Co. at the "deutschfest," or German dinner, served in the New Bremen American Legion Hall. A five-piece German band played during dinner.

The first tour after the dinner was of Stamco, Inc., where power squaring shears, slitting and coiling machine were seen in various stages of construction.

Next, the group adjourned to Minster Machine Co., where it saw construction and erection of the firm's fourteen different styles of mechanical presses. Among guests were ASTE members from Hartford, Conn., Rochester, N. Y., Pittsburgh, Chicago, Findlay, Ohio, and Toledo.

—*Donald Cox and Gene Stemen*

Hugh Silbaugh Lectures at Binghamton

Meeting at the Vestal American Legion, 44 members of the Binghamton heard a talk by Hugh Silbaugh, sales production manager of Ozalid, Johnson City, N. Y. He discussed "Ozalid—The Process, The Products and The Uses." He gave a detailed description of how the process works, its history and growth since its introduction to the U. S. in 1934. Auxiliary applications as well as the broader uses were also discussed. —*Paul J. Adamek*

Ed Camen, Dick Myers and Nick Schneider, from left, were among those who toured the Cross Co. with the Detroit chapter.

Carbide Failure Topic at Cincinnati Meeting

Ninety-five members and guests were present for Cincinnati chapter's October 21 meeting at the engineering Society Building. Guest technical speaker was W. L. Kennicott, chief engineer at Kennametal, Inc., who discussed detection of cause in carbide tool failures and methods best suited to overcome this problem.

Another feature of the program was a film "In the Beginning," produced by Mobile Oil Corp. It showed the tremendous surface changes which took place on the earth over several billion years.

A special guest was Dr. Lawrence H. Cook, owner of Cook Research Laboratory, Menlo Park, Calif. He is a member of Santa Clara Valley chapter and of the National Membership Committee. Dr. Cook spoke briefly of his recent trip to Milan, Italy, and the Leipzig Fair in East Germany.

—*Frank Houston*

Detroiters Make Visit to Cross Co. Plant

Members of the Detroit ASTE chapter toured the Cross Co. of Detroit, machine tool builders in the field of automation, on October 14. Included in the tour were the engineering department, machine shop, subassembly and assembly departments.

A sound color film of the Cross tool control system was also shown and members were able to see some machines completely built and ready for delivery.

On October 7, Malcolm F. Judkins, manager of the New Products Div. of Firth-Sterling Corp., Pittsburgh, spoke on "Future Requirements of Carbide" before a meeting of the Detroit chapter's carbide section. He discussed high-temperature alloys which have contributed much to the development of jet propulsion and other ordnance work.

On October 21. E. V. Crane of the E. W. Bliss Co., Canton, Ohio, was guest speaker for a meeting of the chapter's student section. In his talk, Mr. Crane classified plastic flow of metal and described metalworking operations, metal structure, slip-pane movement and work hardening, the plastic cycle and the restoration of unstrained structure.

—*Walter Schober*

Indiana Council Plans On-Campus Conference

The Indiana Council, made up of representatives of the Indiana ASTE chapters, is rounding out plans for its third annual Purdue Engineering Conference, to be held April 23, 1955, on the Purdue University campus, West Lafayette. Tentative plans include three sessions. Prof. Orville D. Lascoe of Purdue University was elected chairman of the conference by unanimous vote of the council.

—*John A. Huser*

Springfield Chapter Hears Harry Conn

The regular monthly meeting held October 11 at Springfield Turnverein, was attended by 147 members and guests. Guest speaker was Harry Conn, chief engineer at Scully-Jones & Co., Chicago. His topic was "Tooling for Carbides." Another feature of the program was the film, "Accent on Accuracy," by Pratt & Whitney Division of Niles-Bement-Pond Co.

—*George H. Foy, Jr.*

AKRON CARBIDE SEMINARS—Pictured at two of the recent sessions on carbides sponsored by the Akron chapter, from left, are: Charles Dager, W. J. Greenleaf, Tony Kebe, and S. O'Barto of the Newcomer Co. In the right-hand photo are: George W. Nelson of Norton Co., John Murawski, Francis Rongone and Walter Foreman, also of Norton. —*Ted Bushnell*

ROCHESTER PLANT TOUR—More than 350 ASTE members from Rochester, Buffalo and Alfred University toured the new plant of the Delco Appliance Division of General Motors Corp. on October 4. They were welcomed by Jerald Sick, standing, Rochester chapter chairman. Also pictured are: William Blackman, superintendent of industrial relations at Delco; Harold McInnis, chief tool engineer; James Horne, national ASTE director; Floyd Weed and Jerry Curtin, members of the executive committee. The program also included dinner served in the plant cafeteria.
—*Paul A. Bruno*

Northern Massachusetts Holds Executive Night

County educators and industrialists participated in Northern Massachusetts chapter's annual executive-educational night on October 19. Held in the Memorial Hall, the meeting attracted some 300 members and guests.

Robert S. Harper, assistant general manager of Greenfield Tap & Die Corp., addressed the group on "The Necessity of Technical Education for Industrial Employees."

The after-dinner program was opened by brief remarks from Chapter Chairman J. Robert Moore, and George A. Stanley, Jr., of the education committee told of scholarship awards and other work done to promote training for the tool engineer. Principal William P. Robbins of Petersham High School discussed "Home, School and Industry," giving the educators' side of the picture and Richard A. Smith, a national director of ASTE, awarded affiliate member plaques to several companies. Entertainment was provided by the Union Twist Drill Glee Club.

Special guests included: Senator Ralph C. Mahar of Orange and Senator Elizabeth Stanton of Fitchburg, and Dean George Marston of University of Massachusetts. —*Otto S. Nau*

Dr. Osborn Addresses Battle Creek Members

Speaking at the opening meeting of the season held at Battle Creek, Dr. Harry B. Osborn, Jr., first vice president of the Society, presented a technical program on "Induction Heating and the Tool Engineer." Dr. Osborn is technical director for the Tocco Div., Ohio Crankshaft Co. in Cleveland.
—*Arthur F. Damon*

Harry Conn Addresses ASTE Members at York

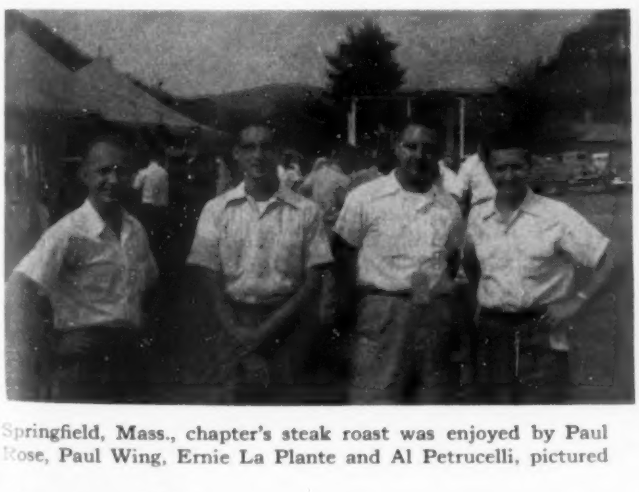
Central Pennsylvania chapter and its guests heard a discussion on production tooling problems at a meeting held October 6 at the West York Inn. Speaker was Harry Conn, chief engineer of Scully-Jones & Co., Chicago, Ill. His talk covered milling arbors, floating toolholders and taps, and showed how many involved problems should be simplified to the basic essentials which can be readily applied to shop practice.

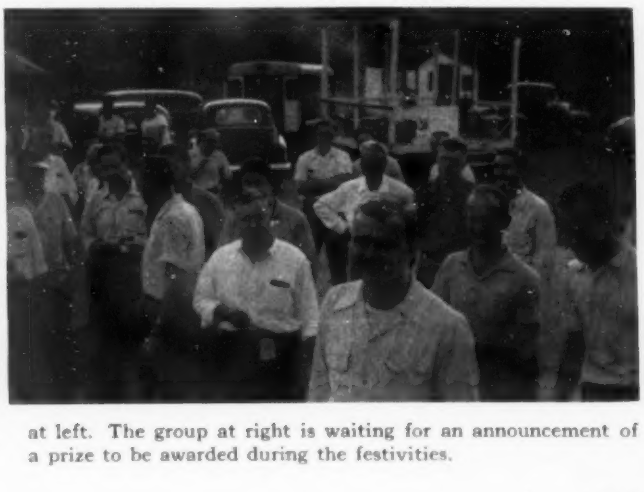
During the business session, Raymond Meckley, the chapter's representative to the committee formed in York to establish an Engineering Council, reported on the group's success. David A. Schrom, National Editorial Committee member, asked members to be alert for technical news of interest to THE TOOL ENGINEER magazine. It was announced that the executive committee had voted to have members of the senior class at the Pennsylvania Soldiers' Orphans Trade School as dinner guests of the chapter at a meeting to be held in April. Mr. Schrom heads the committee in charge.
—*Paul F. Leese*

Massachusetts Chapter Hears C. E. Herington

Southeastern Massachusetts members met October 19 to hear a talk by C. E. Herington, sales manager of Meehanite Metal Corp. He spoke on the manufacture and applications of Meehanite castings.

On September 21, the technical speaker was Harry Conn, chief engineer at Scully Jones & Co., Chicago. His talk centered on production tooling problems, including drilling, tapping, boring and milling. Each meeting was attended by more than 120 members and guests. —*K. W. Nittel*





Springfield, Mass., chapter's steak roast was enjoyed by Paul Rose, Paul Wing, Ernie La Plante and Al Petrucelli, pictured at left. The group at right is waiting for an announcement of a prize to be awarded during the festivities.

Positions Available

CARBIDE SALES ENGINEERS—for Michigan and Indiana. Large, well-established manufacturer of tungsten carbides cutting tools, draw dies, wear-resistant parts and diamond products, operating on a nation-wide basis, requires experienced, capable and aggressive sales engineers to help cover states of Michigan and Indiana. Age 25 to 45. Knowledge of metalworking industry required as some service work is necessary. Salary $400 per month and traveling expenses, plus commission after sales ability is proven. Car furnished. Write letter stating age, education, experience, qualifications and references. Replies held confidential. Interview by appointment only. Write to Metal Carbides Corp., 20485 Van Dyke, Detroit 34, Mich.

SALESMAN WANTED—to call on tool engineers and master mechanics to present a well-established line of drill bushings and allied products. Applicant must have shop experience. Write to Box 014, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

DESIGNER DIES, TOOLS AND EQUIPMENT—expanding manufacturer of automatic control equipment has opening offering excellent opportunity to a design engineer with outstanding experience in the design of progressive and other complicated dies for the fabrication of small intricate parts; must also be familiar with light machining operations and be capable of designing tooling and improving operations. Must be able to re-engineer existing equipment and tooling for the elimination and combination of operations in a manufacturing cost reduction program. Send resume to employment manager, White-Rodgers Elec. Co., 1209 Cass Ave., St. Louis, Mo.

SALES ENGINEER—a prominent machine tool builder, selling its machines directly to the user, has an opening on its sales force for a sales engineer to work in the Detroit and Michigan territory. Applicant should have engineering and shop background. Write to Box 013, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

ENGINEER—to sell production engineering and management consultant service. Should have experience in manufacturing or manufacturing engineering. Graduate engineer preferred. All replies confidential. Metcut Research Associates, 3980 Rosslyn Drive, Cincinnati 9, Ohio.

Positions Wanted

EXPANDING?—Looking for a full-time sales representative for your products throughout Canada? Am well acquainted over period of years. Appreciate your full proposal. Write to C. Ferguson, P.O. Box 173, Calgary, Canada.

TOOL ENGINEER—with a university education desires new position in Canada or will relocate. Is 29 years old and married. Have practical experience in mechanical and tool engineering field (machine shop practice, inspection, design, toolroom). Am available on reasonable notice. Write to Box 010, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

CHIEF TOOL ENGINEER—over 25 years of diversified manufacturing experience. Acted successfully as chief tool engineer, plant superintendent, tool designer and tool and die maker. Will relocate. Write to box 015, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

INDUSTRIAL REPRESENTATIVE—27 years; 6 years experience major industrial accounts in Ontario and Quebec. Interested in representing American company in Canada. Have mechanical background. Write to Box 012, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

EXPERIENCED VENDOR TOOL REPRESENTATIVE—Nineteen years of experience in tool and die, tool design, quality control and vendor contact work. Past six years in aircraft. Would like suitable position. Prefer the West Coast. Write to Box 011, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

TOOL ENGINEER—46 years old with more than 20 years' experience building everything from bombsights to trailers, is interested in a position of master mechanic or an equivalent responsible position. Complete resume available. Write to Box 006, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Michigan.

J. A. Cupler, center, president of the National Jet Co., addressed the Louis Joliet chapter at the October meeting. With him are Ray Eken, left, and Robert Bennett.

Company President Talks on Micro-Drilling

More than 100 Louis Joliet members and guests heard a discussion on "Techniques of Micro-Drilling" at the October 19 meeting held at the Woodruff Hotel. Speaker was J. A. Cupler, president of the National Jet Co., Cumberland, Md., who explained methods of drilling precision holes from 0.001 to 0.006 inch. Members had an opportunity to use Model 7A Vee Drill and also Model 1. Technical chairman was Mr. Behl.

—*Lionell Rohman*

W. J. Stolp Addresses Boston Chapter Meeting

More than 100 members and guests of the Boston chapter attended the October 14 technical session to hear a talk on "Tooling and Fixtures for Optical Comparators." Speaker was W. J. Stolp of the Eastman Kodak Co. He also showed a color film on the manufacture of optics.

Robert E. Dean of the chapter education committee announced the list of speakers and subjects to be covered at the fall technical forum being held at the Massachusetts Institute of Technology. —*Evo P. Castelli*

Twin States Chapter Holds Clambake

Lobster and clams were featured on the menu for Twin States' annual outing and clambake held September 18 at Crown Point Country Club, Springfield, Vt. A crowd of 147 members and guests attended. In spite of the rain which marked most of the day's activities, golfing, horseshoe pitching and baseball game went on as scheduled. Door prizes worth about $1,000 were donated for the event by local merchants.

—*Maurice E. Blais*

U. S. Motors Presents Mid-Hudson Program

A film entitled "Rhapsody in Speed" and a discussion on applications of motors with variable speeds were presented by Herbert Van Denend and R. A. Cole at Mid-Hudson's September meeting. The speakers are district manager and sales engineer, respectively, for U. S. Motors. The dinner meeting, held at the Nelson House, was attended by 110 members and guests.

—Davis Gale

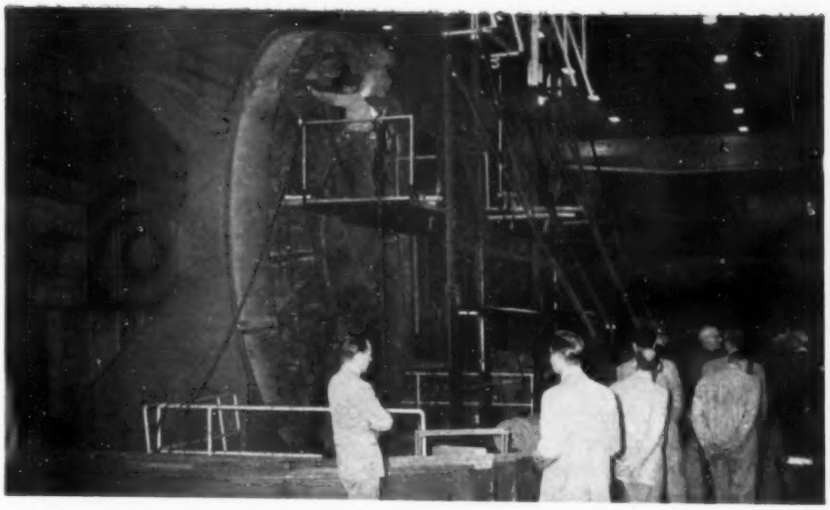
Past Chairmen Guests of Chautauqua-Warren

Two past chairmen of the Buffalo-Niagara Frontier chapter, Erwin Slate and William Iekel, were guests of the Chautauqua-Warren chapter at its October 21 meeting held at the Masonic Temple.

The technical program, which followed dinner, was presented by Edward J. Ferris, assistant superintendent of the machinery division of Pratt & Whitney Electrolimit Jig Borer. A film entitled "Accent on Accuracy" showed the actual research and development involved in the manufacture of the new borer, and many of the difficult machining operations which the unit is capable of performing.

The speaker was accompanied by four company representatives: Donald D. Brumbaugh and Chauncey G. Newton of Rochester; and Edward Stokes and Charles Williams of Pittsburgh.

—Leslie H. Beau Jean



Members of the Greater Lancaster chapter during a visitation at S. Morgan Smith Co.'s plant, pause to look at what is allegedly the largest welding positioner in the world. Approximately 90 attended the October event.

Wives Invited to Los Alamos Meeting

An invitation was extended to the wives of Los Alamos chapter members to attend the October 13 meeting. After a home-cooked spaghetti dinner, the group heard a technical talk by Roger Keough, field service engineer for Scully-Jones and Co. of Chicago, on production tooling problems. Mr. Keough discussed tap holders and expanding mandrels.

In addition to the technical meeting, two films were shown. One was a travelogue on Colorado and the other was on the De Walt saw.

—Basil Boss

Greater Lancaster Visits Local Plant

Following dinner and a brief business meeting at the Pine Tree Inn west of York, Pa., members of the Greater Lancaster chapter toured the S. Morgan Smith Co. for a program on "Engineering the Unusual in Hydrodynamics."

Customer requirements and the size of company products necessitate use of some of the largest machine tools in the world. Members saw 35, 40 and 42-foot vertical boring mills, as well as engine lathes capable of swinging seven feet, which are used for machining generator shafts approaching 40 feet in length.

John Folkenson was elected treasurer of the chapter by the executive committee to fill the unexpired term of Robert Moser who is moving.

At a meeting of the chapter education committee, plans were made to start an educational program in fall of 1955 with Penn State College furnishing instructors for courses. Members attending the meeting were: Coy M. Sesenig, R. Moorehead, J. Reeser, L. Leisey, J. Van Horn, and R. McCord.

—George Gallagher

MID-HUDSON ADULT EDUCATION PROGRAM—Seven tool engineering classes sponsored this year by the Mid-Hudson chapter at Arlington High School have a registration of 90 students, nearly twice last year's total. In recognition and appreciation of the close cooperation of Walter Neidhardt, director of adult education at the high school, who has worked closely with ASTE in organizing the classes, the Mid-Hudson chapter recently presented him with an honorary membership in its education committee. Pictured here, from left: Stanley P. Cook, past chairman and national delegate; Henry J. Tesmer, chapter chairman; Chris J. Noll, Jr., professional engineering chairman; Walter Neidhardt; and C. Morgan Newbury, education chairman.

Family Picnic Held by Peoria ASTE Members

With a full schedule of activities for the whole family to enjoy, Peoria chapter held its annual picnic at Hickory Grove on August 29. The annual ball game between teams from tool design and the planning department at Caterpillar was won by players for the latter team. Games were on the agenda for the children while the ASTE wives played bingo. A delicious dinner was served, with Earl Clancy acting as chief chef.

—Harold Baker

Windsor Meeting Features Talk on Forging Industry

The latest forging techniques were discussed by U. C. Clark, vice president and general manager of the Chambersburg Engineering Co. at Windsor's October meeting. Mr. Clark spoke briefly on recent developments in the forging industry and then showed two films, one on forging equipment and practices and the other on a new technique entitled "Forging in Mid-Air." A lengthy question and answer period followed the program.

Certificates of membership were presented by Ernie Clifton to: Alan Reddock, Art Pickford, Chester Kerr, John Catlin, Bob Ritchie, Keri Lewis, Al Frood, Jim MacBridge and George Omelianoff.

Dennis Swan, chairman of the standards committee, reported that sessions are now being organized to acquaint the membership with the content and application of various standards. Committee members are: E. Clifton, J. Hoba, M. Blainey, P. Ivanchich, W. Maddock, D. Kirkaldy, D. Nexbit and G. Kovosi.

—A. Underwood, Jr.

Buffalo-Niagara Awards Fourteen Handbooks

Buffalo-Niagara chapter awarded copies of the *Tool Engineers Handbook* to fourteen outstanding students at various schools in the area. They were presented during graduation exercises. Books went to college students Donald J. Mokski and Donald Hughes at the University of Buffalo; and Richard Regka and Richard Blenk of Erie County Technical Institute.

Many high school students received books. Recipients were: Richard Bemb of Technical High School; Robert Wohlford of Seneca Vocational High School; Michael Cmor of McKinley Vocational High School; Frederick Brady of Boys' Vocational High School; Daniel E. Folaron of Emerson Vocational High School; Lawrence E. Hewitt and Glen L. Richardson of Trott Vocational High School; David Richardson of Lockport High School; Anthony Kuziora of Dunkirk Industrial High School; and James Werth of North Tonawanda High School.

The chapter's October 14 meeting was held at Hotel Westbrook. Some 84 members were present to hear Jack Warner and William Thomas, research engineer and district manager, respectively, of S. C. Johnson & Son, Inc. They talked on "Production Uses of Metalworking Waxes."

—A. W. Millet

Art Olmer, director of training, industrial relations group, Boeing Airplane Co., was the guest speaker at the Seattle meeting.

Art Olmer Speaks to Seattle Tool Engineers

Seattle chapter opened its 1954-55 season with a September meeting held at the Town and Country Club. The 75 members and guests who attended the meeting heard a talk by Art Olmer, director of training, Industrial Relations Group at Boeing Airplane Co. in Seattle, Washington.

His topic was "Report Writing for Engineers," in which he stressed the importance of using short words.

—Gerald Rosenfield

New Orleans Tour

Members and guests of the New Orleans chapters toured the Kaiser Aluminum & Chemical Co.'s plant in Chalmette during October. They saw all stages of making aluminum from beginning to end. *—Joseph Natal*

Des Moines Members Hold First "Gimmick" Session

An innovation in technical programs for the Des Moines chapter marked the opening meeting of the season held September 15. Promoted by program chairman Don Waggoner, the new slant involved a "Gimmick" session at which members can discuss pet ideas or gimmicks during a portion of each meeting.

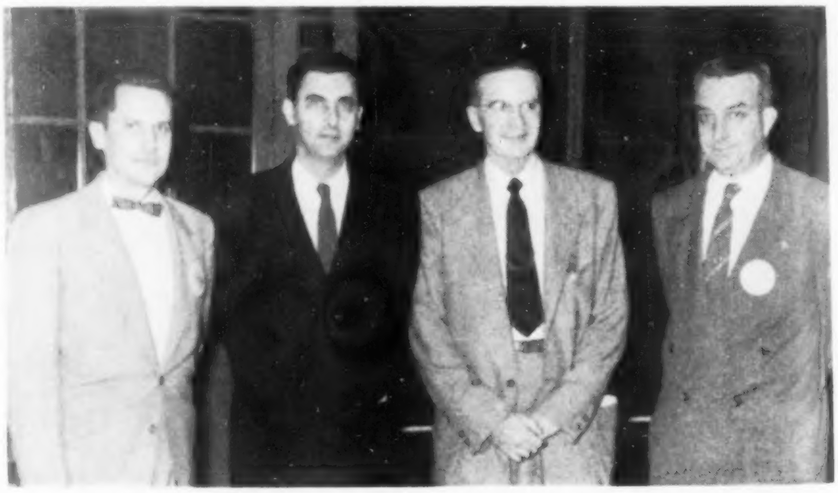
First member to participate was Burt Richardson, production engineer for Beam Mfg. Co., Webster City, Iowa. His discussion centered on a burnishing tool devised for sizing blind bushings.

The technical session proper was conducted by Ted Froeberg of Optical Gaging Products, Rochester, N. Y. He used a series of slides and a film to explain the application of optical equipment for production checking of finished parts. *—J. J. Schlesselman*

Niagara Members Hear Discussion on Abrasives

"What's New in Abrasives" was the topic covered by O. McIntyre of the Norton Co. of Canada, Hamilton, Ont., at the Niagara District chapter's October meeting. Mr. McIntyre is manager of sales engineering for the company. His talk was supplemented with a film entitled "Grits That Grind."

After a brief history on the different types of abrasive grinding wheels that have been developed since 1895, the speaker told about the products manufactured at Norton and described their various applications. *—William Yaeger*



EVANSVILLE HOLDS JOINT MEETING—A program on "Surface Finish and Quality Control" drew an attendance of 125 members of the Evansville chapters of ASTE and the American Society for Quality Control at a joint meeting held October 11. Speaker was John Harrington, third from left, chief engineer for the DoAll Co., Des Plaines, Ill. With him are: from left, Charles Walker, Jr., ASTE program chairman; Harry Gregory, ASQC chairman; and John Race, far right, ASTE chapter chairman.—*Guenther F. Wulf*

Dayton Chapter Tours Sheffield Corp. Plant

The October 11 meeting of the Dayton chapter was held at Sheffield Corp. with dinner served in the cafeteria, courtesy of Sheffield. The meeting and plant tour were attended by some 275 members, a good crowd in view of the fact that on this night the tail end of Hurricane Hazel was whipping through Dayton with terrific rain and wind.

During the business portion of the meeting, the chapter elected its nominating committee for 1955 officers who are Larry McAfee, chairman, Chester List and Gordon Letsche.

Lawrence Cook, member of the National Membership Committee, addressed the group on his visit behind the Iron Curtain in East Germany at the recent tool show. First Vice Chairman Victor Boll of Sheffield Corp., who arranged the meeting for the chapter, and introduced Jack Welsh of Sheffield who discussed his recent trip to a machine tool show in Italy.

Two Sheffield representatives, Harry Kiefaber and Ernest Pawley, talked and showed slides of precision air gages and an ultrasonic machining.

—*W. J. Killinger*

Edward Polidor Talks at Portland Meeting

Technical speaker at the October 8 meeting of the Portland, Me., chapter was Edward C. Polidor, vice president and director of research and engineering of Optical Gaging Products, Inc.

Mr. Polidor gave a brief history of optical comparators and projection inspection, demonstrating with slides the basic principles of an optical projector and various types of comparators. His discussion was followed by a film.

—*Henry C. Hagman*

Vice President Talks at Peterboro Meeting

The 65 members and guests attending Peterboro chapter's October 7 meeting heard a talk by M. McAuley, vice president in charge of eastern operations at Stevenson and Kellog, Ltd., engineering consultants at Toronto. His subject covered "Methods-Time Measurement—A Management Technique." Introduced by Past Chairman L. Hansler, Mr. McAuley discussed problems in human relations problems, high cost operation, falling markets and low profits, and told how M-T-M helps to eliminate such problems.

—*Donald G. Moorby*

ERIE PROGRAM SPEAKERS—Heard by Erie chapter members at the October meeting were; from left, C. R. Mitchell, member of the National Education Committee; Lt. Francis Jarecki, Polish flyer; William Snook, Erie chapter chairman; E. J. Kruszka, dean of the technical school at Alliance College; and Dr. A. O. Coleman, president of Alliance. The program also included a film on the Multipress.

Famed Flier Speaks at Erie Meeting

Speaking at the October meeting, Lt. Francis Jarecki, one of the two Polish fliers who delivered the Soviet MIG to the United States, told Erie members about life as it exists today in countries behind the Iron Curtain. Now a student at Alliance Technical Institute at Cambridge Springs, Pa., where the program was held, Lt. Jarecki spoke to an audience of 65.

Also featured on the program were brief talks by Dr. A. P. Coleman, president of Alliance, and E. J. Kruszka, dean of the technical school. C. R. Mitchell of the National Education Committee discussed the history and goals of the Society. Along more technical lines, a film on the Multipress and another on personnel relations were shown at the end of the meeting.

—*Samuel A. Fiorenzo*

Ann Arbor Students Hold Membership Drive

University of Michigan student chapter, at Ann Arbor, has completed a successful fall membership drive which netted the chapter 18 new members. A booth featuring a photographic display was set up during registration week, and was manned by student members.

Photographs were supplied by Aluminum Company of America, Cleveland Automatic Tool Co., and Barber-Colman Co. In addition, "The First Hundred," a film commemorating the centenary of the University of Michigan Engineering School, was shown to better acquaint freshmen and transfer students with their new school.

On October 13, members of the chapter toured the Ford transmission plant in Livonia.

Tri-Cities Chapter Tours Iowa Plant

A plant tour of the Clinton Co. at Maquoketa, Iowa, marked the October meeting of the Tri-Cities chapter. Dinner was served in the company cafeteria, after which officials conducted members and guests through the plant.

Of particular interest to the visitors were various applications and wide use of die castings in the manufacture of Clinton air-cooled engines for power mowers, saws and boats. Refined tooling for high production was evident in a most interesting display of modern methods.

—*Clifford C. Vogt*

Brown & Sharpe Program Given at Piedmont

Fifty members of the Piedmont chapter met on October 11 for a technical session on precision inspection techniques. Speaking to the group was William T. Nystrom, precision tool sales manager, Brown & Sharpe Mfg. Co., Providence, R.I. His talk featured a discussion on precision gaging fundamentals and details and was followed by a film showing the Brown & Sharpe plant.

The nominating committee to select the 1955 slate of officers was announced, and include Ed Zagora, E. N. Deitler, and A. E. Moosbrugger.

—*Howard A. Longfellow*

Fairfield Program

More than 65 members of the Fairfield County chapter met October 6 to hear a talk on surface finish in industry. Technical speaker was F. W. Witzke of the Brush Electronic Co., Cleveland, Ohio. The meeting was held at the Hitching Post Inn at Bridgeport.

—*Henry E. Busby*

HOUSTON HUMOR—The joke must have been a good one, judging from the smiles on this trio of Houston ASTE speakers. From left: George L. Boehm, S. C. Johnson Co., who spoke on wax coolants for metalworking; H. E. Collins, third vice president of the Society, who spoke on the chartering of ASTE's San Antonio chapter; and H. G. Boswell, Houston chairman. It was announced at this October meeting that the University of Houston On-Campus Conference will be held April 22-23, 1955. *—Virgil Ferguson (Photo by Lee Dolan)*

Long Island Holds Old Automobile Night

The Long Island chapter reports one of its most unusual and successful meetings, Old Automobile Night, which was held October 11 at the Garden City Hotel. Henry Ausin Clark, proprietor of the Long Island Automotive Museum, presented a program of antique and classic automobiles.

Mr. Clark exhibited a color slide collection of automotive collectors items, commenting on interesting features of each.

After the presentation, Mr. Clark and some of his fellow antique automobile enthusiasts participated in a panel discussion. Panel members included N. J. Brooks of the C. M. Johnson Co.; Van Wyck Hewlett; H. H. Treadwell; Gordon Ayer; and Robert Bohaty.

On October 18, Long Island chapter held a panel on machine shop layout, moderated by George C. Bennett, chapter chairman. Panelists highlighted their discussions with many plant layout charts, photographs and three dimensional models.

Participating were: Max Knitter, manufacturing superintendent, Bulova Research and Development Laboratories, Inc.; Bert Paul, plant layout engineer, Fairchild Engine and Airplane Corp.; Otto Leutz, director of planning, Fairchild Camera and Instrument Corp.; A. G. Hamilton, plant layout and equipment engineer, Republic Aviation Corp.; W. Kirschner, tool engineer, Liberty Aircraft Corp.; and Len Wheeler, assistant chief tool engineer, Grumman Aircraft Engineering Corp.

—Jerome Barfus and Bill Bruning

Henry A. Clark, Jr., left, proprietor of the Long Island Automotive Museum, and George Bennett, Long Island chapter chairman, discuss a successful Old Automobile Night program.

Atlanta Tool Engineers Hear John Harrington

The October 18 meeting of the Atlanta chapter featured a talk by John A. Harrington, chief engineer of DoAll Co., Des Plaines, Ill. In his talk, Mr. Harrington brought out various aspects of surface finishing by grinding. Balancing and paper dressing of grinding wheels were also discussed.

The past chairman's pin was presented to Charles D. Toney on behalf of the chapter by Harry K. Grant.

—John F. Morris

Cedar Rapids Meets with Three Organizations

On October 26, Cedar Rapids chapter held a joint meeting with the National Association of Cost Accountants, the American Society for Metals and the Industrial Engineers Association of Iowa at Hotel Montrose.

The guest speaker was Dr. Gerald J. Matchett, director, National Center of Education and Research in Dynamic Equipment Policy, Illinois Institute of Technology. He chose as his topic "Equipment Obsolescence and Replacement." *—Robert J. Bloch*

Montreal ASTE Members Hear Dr. A. O. Schmidt

Representatives of Kearney & Trecker Corp., Milwaukee, Wis., presented the technical program at the September meeting of the Montreal chapter. Speaking to 150 members at the I.A.C.O. Building were Dr. A. O. Schmidt, research engineer, and J. L. Wessolowski, assistant to the sales manager. Their talks, illustrated by slides and a film, were on the subject, "Today's Machine Tool Requirements."

On October 20 the chapter heard a talk by Harry Conn, chief engineer at Scully-Jones & Co., Chicago, Ill.

—F. C. Henderson

Worcester Holds First Annual Education Night

Worcester chapter inaugurated its first annual education night on October 7. The program included awarding of first scholarship in tool engineering to Worcester Junior College, by Ralph Baker, chairman of the scholarship committee.

A special guest was Joseph P. Crosby, ASTE national president, who spoke on the part of ASTE in education of the tool engineer. Other guests included Walter B. Dennen, director of Worcester Boys' Trade School; Harold Bentley, director of Worcester Junior College and Prof. McCullough of Worcester Tech. *—John C. Lalor*

R. J. Nist Speaks at Wichita Chapter Meeting

When Wichita chapter opened its fall season with a meeting at Wolf's Cafeteria, some 60 members and guests were on hand. Guest speaker was R. J. Nist, sales representative, Drill Unit Division, Rockwell Manufacturing Co., Pittsburgh.

Mr. Nist discussed air hydraulics as it is applied to high production machine tools. *—John G. Temple*

ELMIRA PLANT TOUR—Shown at the visit made by 200 ASTE members and guests at the Ithaca, N. Y., plant of the Morse Chain Co., are, from left: James V. Davis, head of personnel and industrial relations of the firm; Arthur W. Green, ASTE second vice chairman; Francis Shepherd, first vice chairman; H. N. Bliss, Myron Hawley, G. E. Fenton, R. Campbell, C. E. Hooks, all of Morse Chain; and C. F. Roe, Elmira chapter member.—*Earl E. Marks*

Twin Cities Tours Donaldson Co., Inc.

Members and guests of the Twin Cities chapter visited the Donaldson Co., Inc., for a plant tour as part of the October 6 meeting. More than 100 persons participated in the visitation which followed dinner and a business meeting held at the Midway Club.

Manufacturers of air cleaners, exhaust mufflers, breathers and pre-cleaners, Donaldson Co. makes products for use on small single cylinder engines, and many of the country's best-known trucks and tractors.

At the business session, it was announced that Norman Sorlie has been elected chapter secretary to fill the vacancy caused by the death of Louis Walton. Mr. Sorlie's position of program chairman is being filled by Arnold Scheering. —*W. J. Comstock*

Corrosion Discussed at Golden Gate Meeting

"Corrosion as an Engineering Problem" was the subject of Golden Gate's September 15 meeting, held at Oakland Willows Restaurant. Some 154 members and guests heard R. S. Treseder of Development Supervision, Shell Development Co., Emeryville, Calif.

Announcements were made that Jim Coulter was appointed to the National Program Committee, and that Hans Metz had been appointed chairman of the chapter standards committee to fill the vacancy left by transfer of Paul Pick.

Ben Berlien of the National Editorial Committee gave a report of a meeting held by the National Editorial Committee. —*Ernest H. Romine*

Stanley Cope Talks at Cleveland Meeting

The meeting of the Cleveland chapter, held on October 8 at the East Side Turners, was attended by 150 members and guests. Speaker on the evening program was Stanley R. Cope, president of Acme School of Die Design Engineering and Colfax Tool Engineering Co., South Bend.

—*Robert H. Snippel*

B. F. Raynes Speaks to San Diego Members

One hundred and fifty members who attended the September meeting of the San Diego chapter heard a talk by B. F. Raynes, vice president of manufacturing and tooling, Rohr Aircraft Corp., Chula Vista, Calif.

Mr. Raynes, speaking on "The Past, Present and Future of Tooling for Aircraft," stressed the need for safe, efficient, low cost and standardized types of tooling and procedures.

A special guest was Wayne Ewing, national secretary of ASTE. Charles F. Derbyshire and A. Ross Campbell of Rohr, were also introduced and gave short talks. —*Buron A. Murray*

Portland Plant Tour

The October 21 meeting of the Portland, Ore., chapter gave members and their guests opportunity to view the complete process of smelting. Some 150 visited the Aluminum Company of America in Vancouver for a two-hour conducted tour by company personnel through the various stages of making aluminum. —*Walter Brenneke*

Regional Meeting Held At Toronto on Oct. 16

Hurricane Hazel and her inclement weather conditions cut down attendance considerably for the Canadian Regional Meeting held in Toronto at the Royal York Hotel on October 16. Twelve stalwart ASTE'rs, however, braved the storm to attend the event.

Hearty individuals on hand were Cliff Farr, chairman of Toronto chapter and chairman of the meeting; David R. Few, Willard Smith and John Lengbridge of Toronto chapter; Chairman Thomas C. Hill of Montreal; Chairman Frank A. Ritchie and John F. Johnston of Windsor; S. S. Pritchard and Bruce McKenzie of Peterboro; Louis Jensen and F. W. Lewis of Lonson-St. Thomas; and Allan Ray Putnam, assistant executive secretary of the Society.

The value of Tool Engineers' Day at the Canadian International Trade Fair was discussed and all agreed that it was a successful operation and should be continued.

John Lengbridge, a member of the National Professional Engineering Committee, made a report of professional engineering registration. David Few of the National Program Committee, stated that his committee is endeavoring to establish speaker tours for the Canadian chapters so that a speaker would be able to complete a circuit without having to double back.

The next Canadian Regional meeting will be hosted by the Windsor chapter and held at National Headquarters in Detroit. The tentative date is February 19, 1955.

Two Michigan Chapters Tour Rubber Plant

The Western Michigan and Muskegon chapters held a joint meeting on October 11 in Grand Rapids at the Varsity Grill. After a short business session, some 113 members and guests adjourned to tour the Corduroy Rubber Co. The tour included observation of weighing, compounding, mixing and milling of the raw materials, to actual shipping of finished products.

Members witnessed manufacture of tires, inner tubes and many extruded and molded parts for the automotive and appliance industry. The meeting was concluded by a question and answer period conducted by Redvers Bullock, personnel director and A. F. Rausell, factory manager. Refreshments were served in the plant cafeteria. —*Jim Rost*

coming ASTE meetings

ATLANTA—Dec. 13, 6:30 p.m., Elks' Club. "Low Temperature Melting Alloys and the Tool Engineer" by O. J. Seeds, president, Cerro de Pasco Corp.

BATTLE CREEK—Dec. 13, 6:30 p.m., American Legion Hall. Welded joints photoelastic demonstration showing stress lines by John A. Borman, assistant to the vice president, Clark Equipment Co.

BOSTON—Dec. 9, New England Mutual Hall. "Plastic Tooling" by Ralph L. Mondano of Raytheon Mfg. Co.

CEDAR RAPIDS—Dec. 9, 6:30 p.m., Hotel Montrose. "Industrial Noise Abatement" by Walter F. Scholtz of the Industrial Health and Hygiene Dept., Allis-Chalmers Mfg. Co.

CENTRAL PENNSYLVANIA—Dec. 1. "Carbide Milling" by A. O. Schmidt of Kearney & Trecker Co.

CHAUTAUQUA-WARREN—Dec. 18, Hotel Jamestown. Annual dinner dance and ladies' night.

CLEVELAND—Dec. 11. Annual Christmas party.

DAYTON—Dec. 11. Miami Valley Country Club. Dinner dance.

DETROIT—Dec. 2, 6 p.m. Student section plant tour of Fisher Body Div. of General Motors Corp., Fleetwood plant. Dec. 9, Latin Quarter. Christmas stag party.

ERIE—Dec. 7. Tour of American Brakeshoe Corp., Meadville, Pa.

EVANSVILLE—Dec. 13, 6:30 p.m. Shrine Temple. Ladies Night.

FORT WAYNE—Dec. 4, St. John's Evangelical and Reformed Church. Annual family Christmas party. Dec. 8, Talk on steel by W. J. Holliday.

GREATER LANCASTER—Dec. 6, 6:30 p.m., Hotel Brunswick Ballroom. Special program by General Electric for ladies night.

GOLDEN GATE—Dec. 3, 7 p.m., Salem Room of Claremont Hotel. Annual Christmas stag party.

GRANITE STATE—Dec. 21. plant tour of Clarostat Mfg. Co., Dover, N.H.

HAMILTON DISTRICT—Dec. 10, Fisher Hotel, Hamilton. "Precision Investment Casting" by B. G. MacKenzie of Deloro Smelting and Refining Co., Ltd.

HARTFORD—Dec. 6. Chapter anniversary night and past chairmen's night.

HENDRICK HUDSON—Dec. 15. "Latest Developments in the Turning Field" by a representative of Monarch Machine Tool Co.

LEHIGH VALLEY—Dec. 10, 8 p.m. Carney Machinery Co., Allentown, Pa. Demonstration on metalworking and woodworking by company representatives.

LIMA—Dec. 4, 6:30 p.m., Royal Pine Room. Annual ladies night dinner dance.

LONDON-ST. THOMAS—Dec. 16. "Stump the Experts" panel discussion.

LONG ISLAND—Dec. 13, 8:30 p.m., Garden City Hotel, Garden City, L.I., N.Y. Talk by George Stern of American Electro-Metal Corp.

LOUIS JOLIET—Dec. 21, 6:30 p.m. Woodruff Hotel. "Diamond in Industry" by Jan Taeyaerts, president of Precision Diamond Tool Co.

MILWAUKEE—Dec. 9, 6:30 p.m., Wisconsin Motor Corp. Plant tour.

MONTREAL—Dec. 16, Business meeting and reception.

NORTHERN NEW JERSEY—Dec. 7, 8 p.m., Hotel Robert Treat, Newark, N.J. Combined meeting with Carbide Society. Speaker from Firth Sterling, Inc.

NORTHERN MASSACHUSETTS—Dec. 14, 7 p.m., Greenfield, Mass. "Anti Friction Bearings" by B. K. Lathbury, Boston district manager of SKF Industries, Inc.

PORTLAND, ORE.—Dec. 10, Amato's Supper Club. Christmas party.

ROCKFORD—Dec. 9, Forest Hills Country Club. Ladies night and dinner dance.

SAGINAW VALLEY—Dec. 4. Christmas party.

SAN FERNANDO VALLEY—Dec. 1, 7 p.m. Hody's Restaurant, North Hollywood. "Gadgets" by Don L. Davis of the Gadget of the Month Club, Inc. The one-hour gadget program will be followed by two hours of dancing.

SAN GABRIEL VALLEY—Dec. 2, 7:30 p.m., Rainbow Angling Club, Azusa. 'Gages" by Comdr. William Dubyk, USN, of the Naval Ordnance, Pasadena.

SANTA CLARA VALLEY—Dec. 21. "How to Make Money by Proper Use of Accounting" by Wesley Taft Benson, CPA from San Francisco. Speaker courtesy of National Association of Manufacturers.

SOUTHEASTERN MASSACHUSETTS—Dec. 21, New Bedford. "Modern Methods of Inspecting by Optical Inspection" by H. L. Marsh of Jones and Lamson.

SPRINGFIELD, ILL.—Dec. 14, L[illegible] Club. Christmas party for members and ladies.

SPRINGFIELD, MASS.—Dec. 13, 7:[illegible]0 p.m., Springfield Turnverein. "Broaching" by James Whittington of Cincinnati Milling Machine Co.

TOLEDO—Dec. 8. Panel on "Automation."

TRI-CITIES—Dec. 4, 6:30 p.m., Johnny Hartman's. Ladies night.

TWIN CITIES—Dec. 1, Covered Wagon. "High Temperature Tooling" by H. H. Harris of Alloy Engineering and Casting Co.

UNIVERSITY OF KANSAS—Dec. 9, 7 p.m., Fowler Shops. Students will hear "Plastic Tooling" by Erwin Gerhareer, chief engineer, Laco Machine and Tool Co., subsidiary of Lukins Aluminum.

WESTERN MICHIGAN—Dec. 13, 7 p.m. Varsity Grill. Joint session with American Society for Quality Control. "Civilization through Tools" by a representative of DoAll Co.

WILLIAMSPORT—Dec. 13, 7 p.m., Elks' Club. "Automatic Equipment" by Stanley Gardner, chief machine designer, Sylvania Electric Products, Inc.

WINDSOR—Dec. 13, 6:45 p.m., Prince Edward Hotel, Windsor. "Art of Gear Manufacture" by Charles R. Staub, chief engineer at Michigan Tool Co.

Milwaukee Selects Winner of Scholarship Award

After considerable study, Roy Radke, chairman of the Milwaukee education committee, announced recently that Marvin Moersfelder is the winner of the chapter's 1954 scholarship award. A graduate of Boys' trade and Technical High School, Mr. Moersfelder is now studying at the Engineering School at Marquette University at Milwaukee. The scholarship program at Milwaukee was one of the first to be established by an ASTE chapter. It was set up by Mr. Radke who has done an admirable job in selecting student winners for the award. He is director of the Industrial Art Department for the Milwaukee public schools, and for many years has been in charge of the education committee. The chapter has set aside a fund to insure perpetuation of the scholarship for some time to come.

—Walter Behrend

Moersfelder

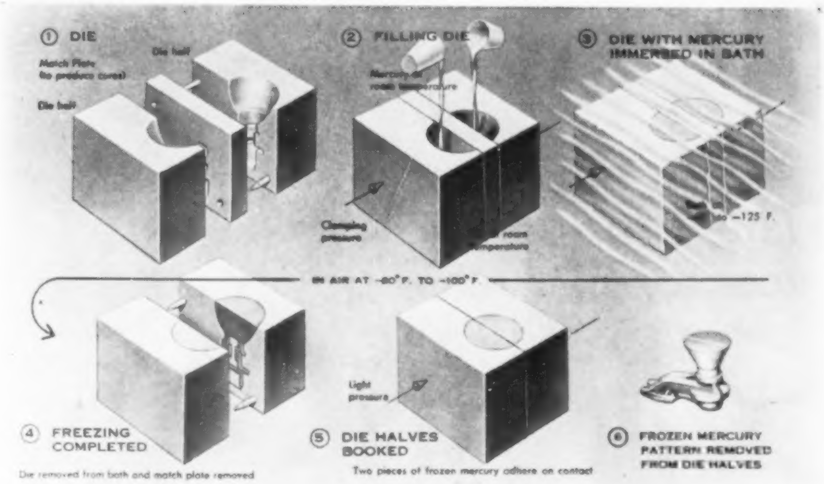
PROGRESS in production

CASTING WITH MERCURY FOR INTRICATE WORK

Design of parts of considerable complexity are now practical because of a method called "booking" used in the frozen mercury process of investment casting.

To create a finished piece with the frozen mercury process, the original die is made in two identical halves. Each half serves as a complete unit and is separated from the other part by a match plate that is perfectly smooth on both sides. Dowel pins extending through the match-plate link the separate halves.

The accompanying illustration shows the step-by-step operations involved in the casting work. Liquid mercury is poured into the die parts. Immersion in a subzero bath follows until the mercury is frozen. When this is accomplished, the die is opened and the match-plate removed. The two sides, now realigned by the dowels, are placed together bringing the opposing smooth surfaces of the frozen mercury pattern into perfect contact. Only a light squeeze or tap against the die is sufficient to cause these mercury surfaces to weld and form a single monolithic pattern.



This method of booking is not limited to joining only two sections. Patterns have been made with as many as twelve separate booking operations to furnish extremely intricate single-unit finished castings.

Because of the large and intricate castings that can be produced in this manner, cost savings are realized since entire assemblies can be purchased as a single unit. This eliminates assembly operations, reduces inventories of many individual parts and reduces or possibly avoids the necessity for subsequent machining operations.

ECONOMY TIPS FOR DIAMOND DRESSER USERS

Plants which are big users of grinding wheels probably also are users of a large number of diamond dressers. With the expense undoubtedly involved, it may pay to take advantage of the care-and-treatment formula for economic diamond dresser technique that has been outlined by Carboloy Dept. of General Electric Co.

First on the list of how to avoid trouble when using cluster-type diamond dressers, according to Carboloy engineers, is to make sure operators follow the practice of turning the dressers daily. This cuts down on reconditioning.

Actually, operators using diamond dressers should avoid trouble to begin with. This is possible, on the whole, if these procedures are followed:

1. Set the diamond dresser so it travels across the wheel with a 10 to 15-deg lead angle.
2. Keep the dresser on, or slightly below the center line of the grinding wheel.
3. Give the dresser a 5-deg drag angle on work where this seems helpful.
4. Use slightly faster traverse speeds.
5. Take light cuts—not more than 0.002 in. per pass.
6. Use plenty of water coolant.
7. Turn dresser frequently to present new diamond cutting faces to the grinding wheel.
8. Recondition diamond dressers periodically to expose new diamonds.

Reconditioning presents no great task. It usually takes only about two minutes. In the type of dresser which uses small diamonds, the dresser needs

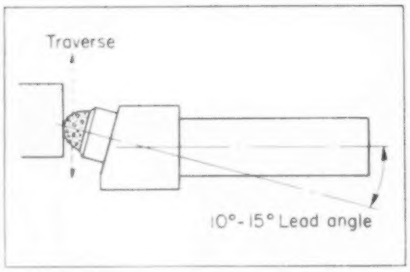
reconditioning when the diamonds are worn flush with the matrix in which they are embedded. Grinding away some of the matrix, by simply rolling the dresser both up and down and sideways against a soft silicon carbide wheel, exposes new diamonds. A dresser may also be reconditioned by holding it in a drill chuck and feeding it into part of a broken silicon wheel. Still a third way is by sandblasting.

In some plants such a program of preventive maintenance has not been followed and trouble is dealt with as it appears. For these shops, there are two specific wear indications that trouble shooters should look for.

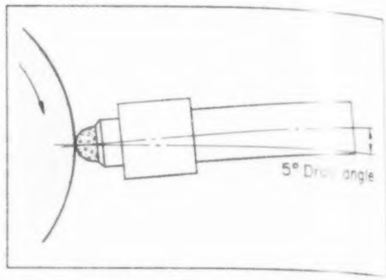
If a grinding wheel dresses to taper shape, the dresser should be turned to expose more diamonds. In this event attention should be given to more reconditioning, or a larger size diamond dresser should be used.

If the grinding wheel looks glazed, either the traverse speed of the dresser is too slow or the màtrix of the dresser is in contact with the wheel. Too much dresser face in contact with the grinding wheel also may produce this glazed effect, in which case the dresser should be turned.

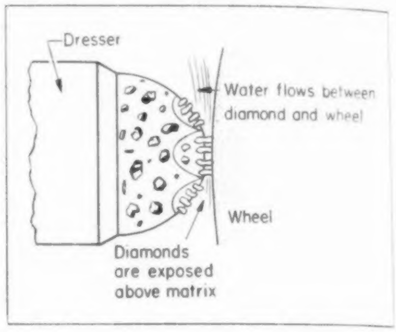
Carboloy engineers offer these general rules of practice for grinding wheel operators: To obtain better grinding wheel finish, reduce in-feed and traverse feed; to get more pieces per dressing, increase in-feed and traverse feed.



Set cluster-type dressers at 10 to 15 deg lead angle Keep dresser on or slightly below, never above, centerline.

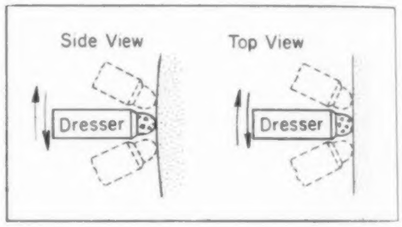


A 5-deg drag as well as using slightly faster traverse speeds may be helpful. Light cuts—not over 0.002-in. per pass should be taken with this type dresser.



Cluster-type dressers should be reconditioned occasionally to expose new stones.

Below: Two techniques for exposing new diamonds—note dresser should first be removed before following either way.



PRODUCTION UP—TIME DOWN FROM TOOLING CHANGE

One cut is accomplishing the same job at Fred N. Wells Inc. that it used to take five passes to do. Work involves milling $2\frac{1}{4}$ x 3 x 156 inch long offsets in aircraft spars on a 20 hp Ingersoll double-side head planer mill built before 1920.

Originally high-speed steel shell cutters were used, and it took about 20 hours to mill two bars. Step mills with Kennametal tungsten carbide-tipped inserted blades were substituted to do the work and proved capable of doing it in one pass, performing at increased speed with resultant longer life between cutter regrinds, and, of course, greater output.

The hogging cut is made on two bars at one time using a 5-inch diameter left and right-hand cutters with four inserted blades. To obtain the higher operating speeds for most efficient use of the new cutters, roller bearings were installed in each side head-spindle. Now the $2\frac{1}{4}$-in. wide cut is taken at $1\frac{1}{8}$ ipm and 160 rpm as compared with the 2.5 ipm with 44 rpm previously run with the shell mills.

All four blades in the new cutter have a 7-deg negative radial rake; blades 1 and 3 have a 10-deg positive axial rake and blades 2 and 4 have 10-deg. negative axial rake.

In the work operation, climb milling is used to within three inches of the bars ends, after which the ends are cut off. This method is used because the machine has no backlash control on its feed gear. Formerly, each high-speed steel cutter required three regrinds to mill one piece. Now two bars are milled before cutters are reconditioned. Regrinding is done on a conventional tool offhand grinder in only 30 minutes.

Each of the four lug-type blades, shown on workpiece, take proportionate amount of the $2\frac{1}{4}$-in wide cut at $1\frac{1}{8}$ ipm and 160 rpm. With these cutters, milling time amounted to only 20 min.

TOOLS of today

Vertical Turret Lathes

Following three years of experimental work, The Bullard Co., 286 Canfield Ave., Bridgeport 2, Conn., has introduced a line of vertical turret lathes, the Cut Master Model 75, that offers complete changeover in design. Prime feature of the design is the single movable pendant station from which all functions of the machine are controlled —a centralization made possible by the hydraulic shifter unit. The pendant innovation is unusual since it incorporates use of directional lever action for operational ease and safety. Motion of the head, for example, simply follows whatever direction the feed or traverse lever is engaged. Dials on the side of the pendant permit quick selection from the range of 20 table speeds and 16 feeds.

A further feature of these units is the Man-Au-Trol attachment which converts the Cut Master Model 75 from a manually operated to a completely automatic machine. This attachment, a compact unit, may either be purchased with the machine or applied as production requirements make it practical. In use it does not affect the lathe's manual versatility.

Smooth, uncluttered external lines and simplification of maintenance have been stressed in design of the line. The units are built in table sizes of 26, 36, 46, 56, 66 and 76 inches with a variety of head combinations. Delivery dates will begin in January 1955.

T-12-1601

Screw Machine

An automatic single-spindle screw machine is being introduced by The Gear Grinding Machine Co., 3901 Christopher, Detroit 11, Mich. This unit, Screwmatic 750, incorporates three principles that provide high-speed production at lower cost.

Foremost is an infinitely variable spindle-speed drive replacing gearing. On the standard Screwmatic 750, this permits a maximum spindle speed of 5100 rpm, with higher speeds available on request. The machine's infinitely variable spindle drive permits a choice of three different spindle speeds during any work cycle. All speeds are controlled by a simple dial setting and are adjustable during actual cutting.

Reversibility of all forward speeds, activated by air pressure, avoids need of left-hand tools.

Second principle of the design is the V-belt work spindle drive in place of roller chains.

Third principle incorporated is stock feeding through low-pressure air cylinders instead of a constant speed backshaft.

Using standard-size collets and feeders, this screw machine takes bar stock up to 0.750 in. in diameter, 2¼-in. stock lengths are turned with a standard 7-in. cam. Turning lengths up to 6 in. are obtainable with larger cams— an unusual turning length capacity made possible through a turret slide unit which includes the lead cam and drive. The turret slide proper is equipped with a three-position crank setting and the turret index drive with three index speeds. Together they permit turret index strokes of ¼, ⅓ or ½-second turret index time by simple adjustment, considerably widening the range of work which can be produced on one screw machine.

Shorter workpieces are easily and economically accommodated by the readily adjustable turret slide and index stroke and speed. Camshaft cycle speeds range from 1.8 to 240 seconds.

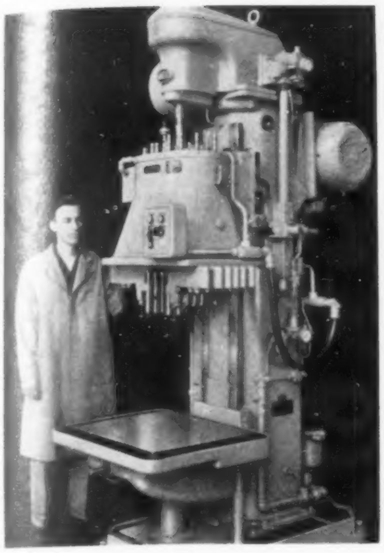
T-12-1602

USE READER SERVICE CARD ON PAGE 175 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Drilling-Tapping Unit

Manufacture of a high-speed, push-button controlled multidrilling and tapping machine for medium-sized work has been announced by the National Automatic Tool Co., Inc., Richmond, Ind. This unit, which is identified as model D225H, offers several features.

An unusual feed and control mechanism minimizes operator motions, mak-



ing more rapid operation possible and therefore increasing production. The unit is available with a single spindle head, an adjustable spindle head or a fixed center spindle head, giving it additional versatility and making possible the multiple drilling or tapping of small holes with economy.

Three feed cycles are possible through the pushbutton control. The standard cycle provides rapid traverse forward, coarse feed forward, fine feed forward, rapid reverse, stop. The jump feed cycle gives rapid traverse forward, coarse feed forward, rapid traverse forward, coarse feed forward, fine feed forward, rapid reverse, stop. The third, or time delay reverse cycle provides rapid traverse forward, coarse feed forward, fine feed forward, dwell against positive stop for predetermined time, rapid reverse, and stop. The latter two cycle patterns require additional equipment. **T-12-1611**

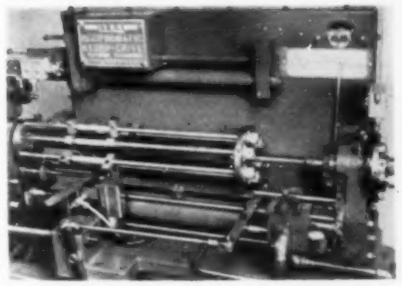
Reciprocating Drive

Drives for ram-type turret lathes with automatic reciprocating action to clear chips in deep-hole drilling have been introduced by Lincoln Industries, Dept. TE, 1123 So. 7th St., Minneapolis, Minn.

Called the Lynn Recipromatic Hydraulic-Drive, this unit provides an automatic cycle for withdrawing the deep-hole drill from the work to clear the chips. The drill then re-enters the hole at rapid traverse to the depth of the cut and continues to drill at normal feed until the chip clearing cycle is repeated. This recipromatic action can be applied to any, or all, of the turret stations. Because chips are cleared automatically at preset intervals, drilling is fast and accurate with results that stand up longer.

All other turret stations are also driven by the hydraulic-drive to make the complete machining cycle automatic. Setup is simple and accurate, making it efficient on short runs. The operator only loads and unloads the machine.

The company has also developed a backfeed feature that can be applied to any or all turret stations with the Lynn hydraulic drive for turret lathes. This makes it possible to put many cross-slide operations on the turret and speed up production. With this backfeed feature, it is possible to make a rough cut going in and a finish cut com-

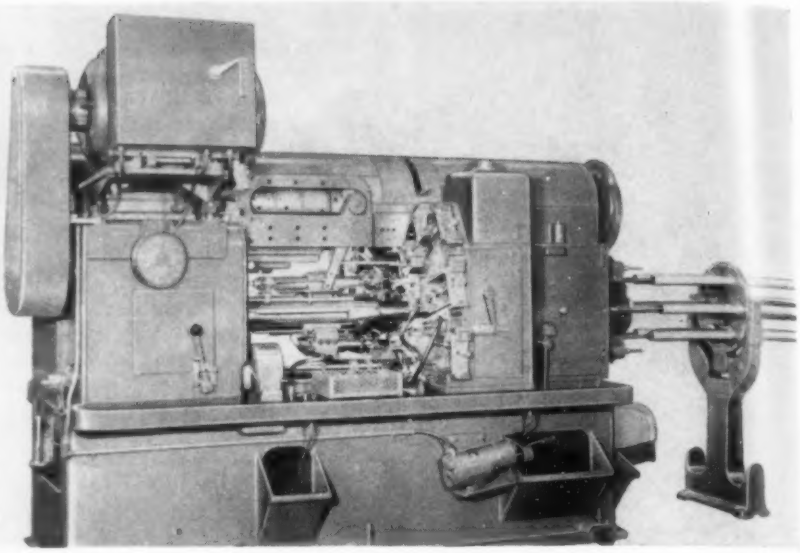


ing out. Feeds of the infeed and backfeed are adjusted independently of each other. **T-12-1612**

Bar Machine

Cone Automatic Machine Co., Inc., Windsor, Vt., has placed on the market its 1⅝ in. model TF six spindle Conomatic bar machine, another member of its line of fast setup and quick job-change units.

Facilities offered by the model TF include general improvements contributing to low-cost usefulness of the machine. Features include larger diameter main end slide with 3¼-in. work center clearance; a 2.5 sec. minimum work cycle; 5 min. maximum work cycle; 1.7 sec. idle time.



This machine has a two-train (fast and slow) spindle speed range with available pairs of pick-off change gears to provide 31 speeds from 128 rpm through 2502 rpm. Working strokes of the six independently actuated main cross slides, main end slide and opposed tool spindles are adjusted by calibrated dial without change of total stroke or interference with positive stop settings, and with minimum change of master cams. It has adjustable and interchangeable heads for opposed tool spindles, and simplified, adjustable, standard mechanical 6-in. maximum length stock feed with provision to accommodate more specialized requirements of greater length by mechanical, air or hydraulic means. **T-12-1621**

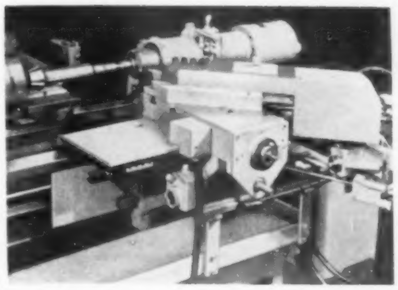
Dip for Copper

Resistance to oxidation for a year or more, dependent on the type of exposure involved, is given to copper alloys treated with Copper-Brite formulation developed by Rossaul Co., 170 Fifth Ave., New York 10, N. Y.

In addition, this bright dip provides freedom from discoloration while parts are in transit, long term protection while on retailers' shelves, permits stockpiling, prior to plating or other processing, and gives resistance to formation of residues that would interfere with conductivity. This safe bright dip, which does not require special drains, is nontoxic, nonfuming, requires no special ventilation. **T-12-1622**

Tracer Control for Automatic Lathes

Multicycle single-point turning of irregular shapes can be accomplished on Sundstrand automatic lathes with a new attachment and controls that permit ruff, semifinish and finish cuts to be taken with one turning tool in one automatic cycle. Only one template is required for all three cuts. The



template controlled tracing slide is mounted to the regular front carriage of the lathe. The machine can be set up for one, two or three cycles. Regular cross feeding rear slide can be used to square up shoulders, chamfer, etc.

Cycle changing is quick and easy—requiring only 5 to 15 minutes, depending on job and number of facing tools to set up. The attachment is available for factory installation only on new Sundstrand automatic lathes.

Details and literature are available from Sundstrand Machine Tool Co., Rockford, Ill. **T-12-1631**

Surface Measurement

Deviations as small as 0.000025 in. on flat surfaces up to 20 in. long can be measured with the Huet optical straightedge instrument developed by F. T. Griswold Mfg. Co., 305 W. Lancaster Ave., Wayne, Pa. This 20-in. model of an earlier instrument available in five or ten-ft lengths, brings ease and accuracy of this measuring method to smaller scale machining or polishing operations. Measurement is made by interruption of a beam of light by the inscribed reticle of a precision feeler microscope.

A prism and lens housing, resting on two metal blocks over the work permits the feeler microscope with its built-in illumination to ride along the surface under examination. Deviations are indicated by the relative position of two indices. **T-12-1632**

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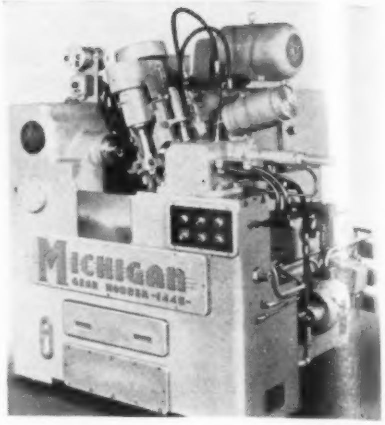
Hobber

An ultraspeed hobber, Model 1445, has been developed by Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich. It offers several engineering changes from previous hobbers, while retaining high-production characteristics such as plunge cutter feed and an automatic workholding tailstock.

A single-spindle hobber, the 1445 will machine both spur and helical gears at selective variable speeds ranging to 570

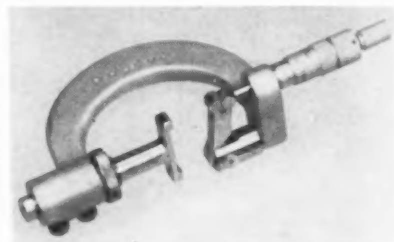


rpm. It will handle up to 8 pitch gears having diameters as large as 5 in. and face width to 4 in. Either climb or conventional hobbing can be utilized.

A universal spindle head design incorporates all required feeds and adjustments for hobbing both spur and helical gears. Design of the unit provides easy and fast workpiece handling geared to needs of the present automation trend. **T-12-1641**

Taper Micrometer

A patented Taper-Mike has been developed by George Gershman to measure taper while a piece is still on the machine without elaborate setup involving a sine bar, gage blocks, a surface gage, etc. Taper measurement can be made as easily and as quickly with



this micrometer as the diameter of a straight bar can be measured with an ordinary micrometer. Accuracy of the Taper-Mike allows measurement of the taper in tenths, and its simplicity of use reduces down time to minutes.

Details are available from the manufacturer, Taper Micrometer Corp., 100 Grove St., Worcester, Mass. **T-12-1642**

Stretch Forming Unit

Full 360-degree arm rotation is featured in the unusual stretch-wrap forming machine announced by Hufford Machine Works, Inc., 1700 E. Grand Ave., El Segundo, Calif.

The Carousel model, so named because the operator rides either arm

during forming, is not only capable of producing many parts previously considered impossible by a single machine, but still produces all conventional parts from both extrusions and sheets up to 22 in. wide.

With its 360-deg arm rotation around a stationary die and table, the Carousel model quickly forms full circles. In addition, the stretch-wrap forming operation can be complemented with a following roller or wiper which operates simultaneously. This roller, attached to one of the rotating arms, may be operated clockwise or counterclockwise.

The unit also does bulldozing, joggling, stretch-straightening, forming reverse bends and "S" curves.

All tension cylinders are double acting—applying either tension or force to the work.

Tension cylinders on the rotating arms are adjustable for height, permitting dies to be set at any level.

A third tension cylinder, mounted on a steel base bolted to the stationary table top at any desired extension, is free-swivelling in a horizontal plane.

Each rotating arm is under independent control and can be operated at variable speeds in either direction.

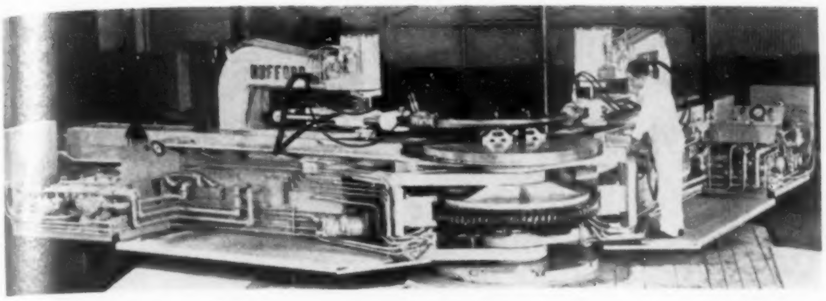
T-12-1651

Form Tool Grinding

Only simple settings are required to accurately resharpen circular cutting tools with the Acorn grinding fixture designed by Pabco Industries, Inc., 6943 West Grand Ave., Chicago 35, Ill. The fixture requires no calculations to operate, yet consistently maintains proper relationship between cutting face and centerline of tool, as well as same degree of hook.

The Acorn fixture adapts to any make of surface grinding machine, with or without magnetic chucks. It also can be used to grind with the periphery or the side of the grinding wheel.

Each fixture is supplied with proper stud and thread for any given type of machine. Additional studs and gages can be had if the tools are to be used on several machines. **T-12-1652**



Gear Tooth Hardener

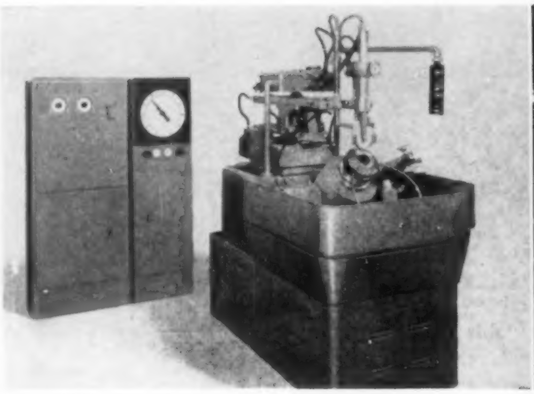
Improved models of Gleason gear surface hardeners produced by Gleason Works, 1000 University Ave., Rochester, N. Y. feature a sensitive electronic control.

On these machines oxy-acetylene flames traverse each individual tooth separately. A sensitive radiation pyrometer, focused on the tooth being heat-

ed, receives radiant energy from the hot metal. This energy is converted by an electronic balancing mechanism into forces which control burner travel along the tooth. Operation of the machines is automatic, after the optimum hardening temperature is preset by the operator and the machine is started.

Heating to the correct hardening temperature, and uniform hardening of all teeth on a gear, and of all gears in a lot, are assured.

The gear surface hardeners are adaptable to hardening teeth of straight or spiral bevel, Zerol, spur, herringbone or helical gears. The No. 1 machine accommodates bevel gears up to 24 inch pitch diameter, spur and helical gears up to 30-inch pitch diameter, and internal gears up to 24 inch OD; the No. 2 machines takes gears up to 120-inch pitch diameter. **T-12-1661**



Left: No. 1 gear surface hardener: electronic control unit is at the far side.

Above: Closeup of the unit in operation. Gun-like barrel in center contains a radiation pyrometer which is focused on the tooth being heated, and also controls travel of the burners along the tooth.

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Automatic Quenching

Accurately controlled quenching of round, flat, shafted, or irregular parts is provided by a series of quenching presses made by the Gleason Works, Rochester 3, N. Y.

These machines are designed to hold and align heated parts during the quenching process, so that they may be hardened with a minimum of distortion. Operation of the quenching cycle is automatic, and is accurately preset by the operator.

Quenching oil is forced uniformly over and around the heated part, with rate of flow controlled accurately at all stages of the quenching cycle.

Each quenching press has a built-in pumping system and oil reservoir. Any of the machines can be arranged to use water, caustic soda, or other quenching medium.

The quenching presses for flat, round and irregular parts are available in three sizes to accommodate parts up to 36 in. in the maximum dimension. In these presses the heated part is held between two dies while the quenching takes place.

The (pictured) rolling quench unit,

for quenching shafts or similar parts, operates by rolling the part under pressure during the quenching cycle, so that hardening is achieved with a minimum of distortion.

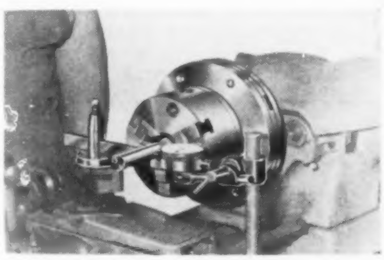
It will handle shafts or other similar parts from 9/16 to 4 in. in diameter, and from 6 to 43 in. in length. Parts with integral gears, cams or shoulders up to 8-in. diameter can be accommodated.

T-12-1671

Lathe Truing

Any lathe chuck, face plate or special fixture can be used with the new precision attachment made by Sanford Mfg. Corp., 1020-P Commerce Ave., Union, N. J., to provide accurate concentricity. Workpiece tolerance to within 0.0001 total indicator runout is assured after the operator makes a simple adjustment requiring but a few seconds.

All trial and error in the truing process is eliminated by the Auto-



Truer, as is the need for toolmakers' buttons or special fixtures on short-run work.

The very simple device permits saving of labor time on toolroom or production lathes, grinding of centers for work between centers, as well as the cost of chuck replacement and lathe tie-ups.

The workpiece is trued by bringing pressure against it with a follower while the lathe is running. This pressure causes the Auto-Truer to shift its center until true center is indicated. The lathe is stopped and the Auto-Truer is locked into position for precision operation.

T-12-1672

Electronic Machining

A precision electrical discharge machine tool, the M-500, has been designed by the Elox Corp. of Michigan, 740 N. Rochester Rd., Clawson, Mich., and Cincinnati Milling Machine Co., Cincinnati, O. following more than four years of research. Incorporating accuracy, sturdy construction and flexibility of adjustment, design of the unit includes several advantageous features. It has a dual coolant supply, consisting of a high-pressure pump and a separate high capacity pump for quick filling of the oil reservoir. The insulated, removable bolster plate is 9 x 15 in., while design of the work pan mounting is such as to provide use of the entire table area which is 10 x 42 in. Bolster plate is movable over the entire work area.

Micrometer adjustment is maintained on longitudinal feed, head cross feed and head vertical feed. It is made to accommodate a great range in sizes of workpieces without loss of accuracy in the machine tool. A $9\frac{1}{2}$-in. travel in the lapped-in quill is provided.

The automatic feed may be disconnected by a simple push-pull operation, allowing for quick handwheel adjustment of the electrode relative to the work. **T-12-1681**

Liquid Heat Guide

Tempilaq°, made of substances of calibrated melting points suspended in an inert, volatile, nonflammable vehicle, has been developed by the Tempil° Corp., 132 W. 22nd St., New York 11, N. Y., as an addition to its line of temperature indicating materials. Availability is in ranges of 113 to 400 F in $12\frac{1}{2}$-deg intervals; 400 to 550 F in 25-deg steps; from 550 to 2000 F in 50-deg intervals. Tempilaq° dries quickly, leaving a mat opaque coating which liquefies when the specified temperature rating is reached.

It adheres well to glass and other polished surfaces, permitting successful temperature checking of power tubes, wire substances and pieces of like exteriors. **T-12-1682**

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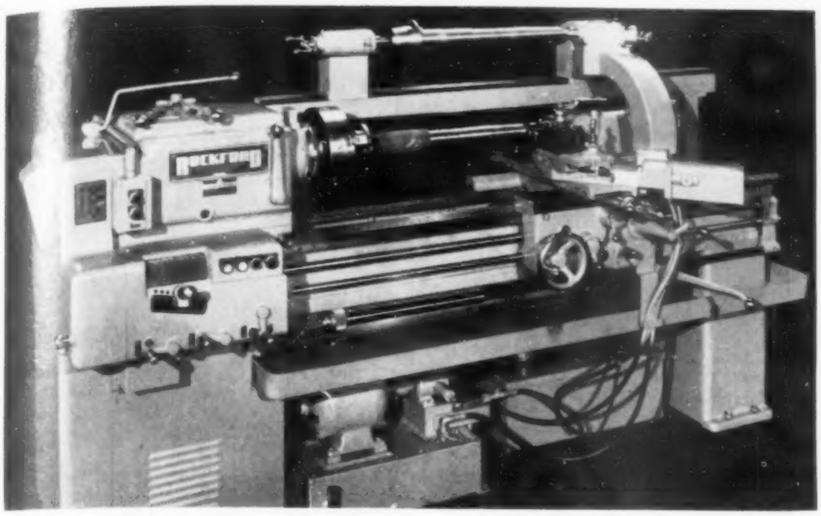
Tracer Lathe

The Rockford Machine Tool Co. has recently added a tracer lathe to its standard line of machine tools. It is an adaptation of Rockford's Kopy Kat duplicator which has been furnished on other machines of their manufacture for several years. All components of the tracer are manufactured by Rockford, facilitating service, maintenance or repair.

The basic machine is an all-geared head, 18-in. engine lathe having 12 spindle speeds, 32 feed changes and bed lengths from 6 to 12 ft. It is powered by a 5-hp motor and offers spindle speeds up to 1140 rpm.

Hydraulic lines from the tracer valve pass through the overarm on which it is mounted and along the apron, clear of chips, coolant and work. The system operates at a maximum unit pres-



Hydraulic Feed

Michigan Drill Head Co., 971 W. Eight Mile Rd., Hazel Park, Mich., has introduced a standard way-type hydraulic feed machine, called the Hydro 3, primarily for use in the shop concerned with small run production.

This machine has a cast iron base with a built-in coolant tank, chip trough and cleanout. Width of the ways is $7\frac{1}{2}$ inches; stroke is 10 inches; feed thrust is 3100 lb; and the ways are automatically lubricated. The motor mounting brackets are capable of mounting $7\frac{1}{2}$-hp 1200-rpm electric motors—maximum for this machine.

Index tables are available with built-in safety features. There are three sizes

sure of 400 psi and develops a total holding force of 1650 lb.

The first piece of a small lot can be manually turned on the lathe and then serve as the master for any number of subsequent pieces. Micrometer adjustment to the master, from the operator's position simplifies toolsetting and adjustment for finishing cuts. The entire capacity of the machine can be used for tracer work.

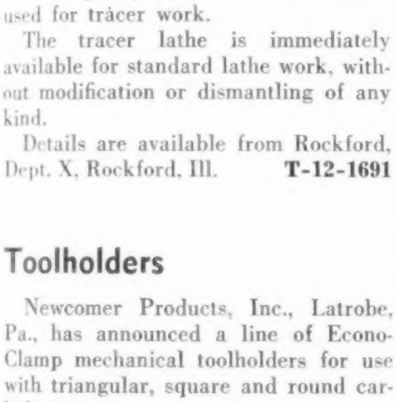
The tracer lathe is immediately available for standard lathe work, without modification or dismantling of any kind.

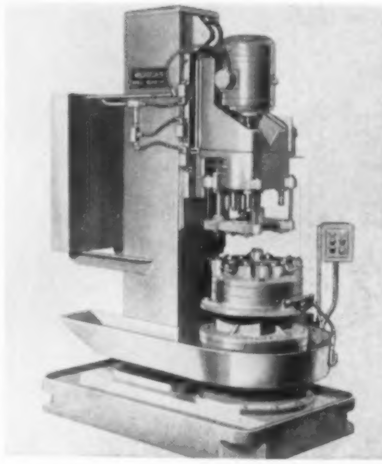
Details are available from Rockford, Dept. X, Rockford, Ill. **T-12-1691**

Toolholders

Newcomer Products, Inc., Latrobe, Pa., has announced a line of Econo-Clamp mechanical toolholders for use with triangular, square and round carbide inserts.

Side and top clamping features of the Econo-Clamp holder, plus a hardened steel anvil, permit the use of all the carbide of any length insert, ranging from the standard $1\frac{1}{2}$-inch length, down to the $\frac{1}{4}$-inch length new Throway insert. Structure and design make it suitable for both heavy roughing and precision finishing operations. **T-12-1692**





—20, 30 and 42—and can be bored from two to fifteen stations.

Standard cycle of the machine is rapid advance feed, positive stop, and rapid return. However, such features as "second feed," "jump feed" and "dwell" can be added at a nominal charge.

T-12-1701

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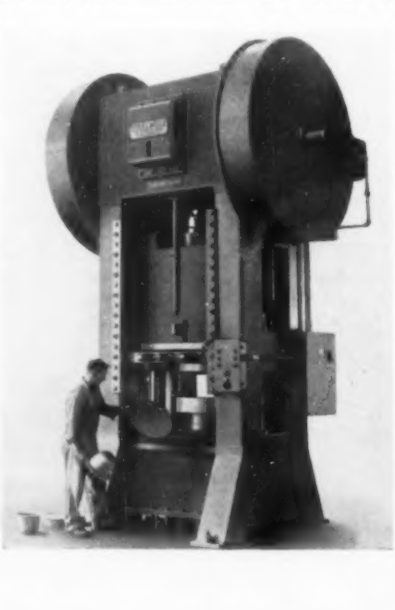
Deep Draw Presses

Presses for high-production deep-draw work have been introduced by the Steelweld Machinery Div., of The Cleveland Crane & Engineering Co., Wickliffe, Ohio.

This line of machines, the Steelweld Hi-Draw presses, are designed to operate at high speeds during the nonproductive portion of the ram stroke and at a slower correct drawing speed during the working part of the stroke. This is accomplished through a newly developed linkage that provides quick approach, quick return and slow constant



velocity through the drawing range.

Press operating speeds can be up to 80 percent greater in strokes per minute than for an equivalent crank press with the same stroke and yet provide the same drawing speed.

Tonnage available at any point in the working range is greater than for a standard crank press.

Steelweld Hi-Draw high-production draw presses are available in single or double-action, one, two or four-point types. Sizes range from 160 tons capacity and up. **T-12-1711**

Fast Tapper

An automatic electropneumatic tapping unit for high-speed sensitive threading with complete elimination of tap breakage has been introduced by Smith & Wiese Co., 1265 W. Second St., Cleveland 13, Ohio.

Design features provide for momentary tap reversals at rates up to 200 cycles per minute. The tap chuck itself is driven through a triple spiral spring

mechanism which is supersensitive in detecting resistance to the cutting force.

Any such resistance puts into effect whatever rate of tap reverse and return is required for the work to proceed smoothly and accurately.

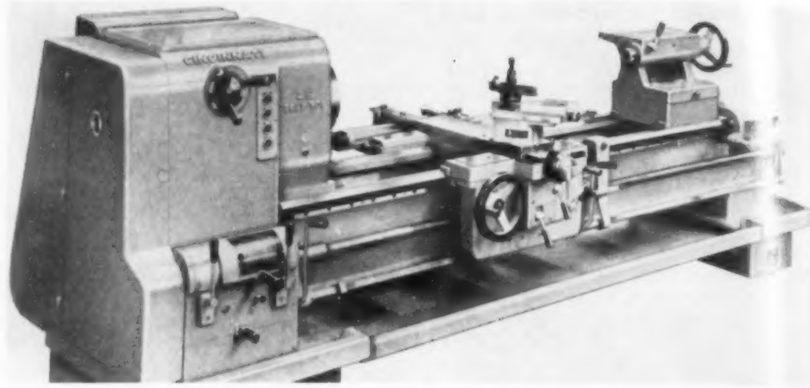
The unit accommodates taps in a size range of from #2 x 56 to 5/16 inch and produces Class 3 threads in materials ranging in hardness up to Rockwell 50 C.

Hole depth can be preset to within $\pm$0.0035 inch, and the unit works equally well in blind holes or through holes.

The machine, which operates from plant air supply in a range of from 70-125 psi, is fully automatic; a complete tapping cycle is carried through at the press of a button or foot switch.

T-12-1712

Lathes



Cincinnati Lathe & Tool Co., 3271 Disney St., Cincinnati 9, Ohio, has announced all-geared head, "Tray-Top" lathes swinging $21\frac{1}{2}$ and 26 in., which are larger machine additions to the family of light and medium-duty "Tray-Tops" introduced some time ago.

These lathes have 12 spindle speeds in geometric progression, with a 3-lever, color-match, direct-reading shift mechanism. The spindle has a long taper key drive nose. An extra-large spindle hole is available.

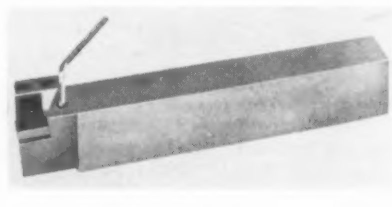
Fifty-four thread and feed changes are made available through a totally enclosed, automatically lubricated quick-change gearbox, where a lever to reverse the leadscrew is also incorporated.

Dealer lists and descriptive literature may be obtained from the company. **T-12-1721**

Tool Holder

An unusual type tool holder using "throw-away" length carbide insert is announced by the Flash Carbide Tool Co., 5311 W. Diversey Ave., Chicago 39, Ill. A very rigid tool, the Flash holder gives at least 36 cutting edges as opposed to one comparable standard tool.

Achieving full support from directly beneath by use of a simple cam-locking device, the Flash holder gives extra long tool life. Hardened high-alloy shank and parts resist washout and wear while the locking device self-

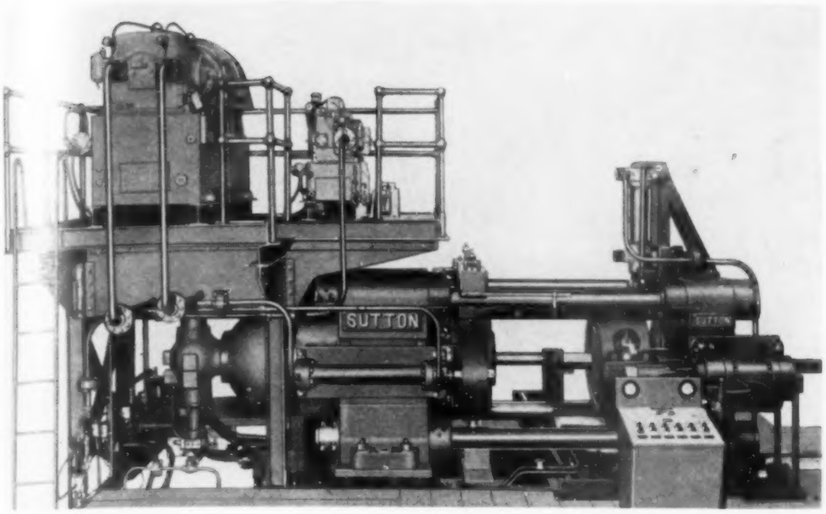


adjusts to wear should it occur. A hardened anvil backs up the carbide in the cut and increases insert life.

Complete chip control can be gained by use of the standard chipbreaker or by grinding the blank chipbreaker to the desired width.

Since neither brazing nor grinding losses are a problem, harder grades can be used with resultant greater insert life.

Down time is minimized since the work center is always maintained once initial setup has been made. Reduced inventories are possible since one holder handles any radius of blank. **T-12-1722**



Lubricant

Mo-Silicone vacuum grease, combining chemical inertness and superior temperature-viscosity relationship of silicone liquids with the temperature and chemical resistance lubricating qualities, of molybdenum disulfide, has been developed by The Lockrey Co., Southampton, N. Y. By the process, silicone, a relatively thin liquid, is thickened to a grease-like consistency by the addition of Lockrey-processed sub-micronized MoS_2, so that it serves as a tight seal against both high and low pressures, as well as a highly efficient lubricant or moving parts.

It serves as a seal and thread compound for making tight threaded joints in stainless steel, glass or other chemical

Extrusion Press

Sutton Engineering Co., Bellefonte, Pa., has announced completion of a 750-ton horizontal, direct-powered extrusion press for aluminum, brass or copper shapes, bars and tubes.

Among its features are extra-fast cycling, positive billet loading, easy die change, heavy-duty shear of extra-high capacity, as well as sensitive control of the main ram. Emphasis has been placed on larger pay load, less maintenance, ease of operation and strong construction.

The press will take a preheated aluminum, brass, copper or magnesium billet 4⁷⁄₁₆ in. in diameter and will extrude solid strips, rod, and hollow or semihollow sections according to the design of the die used. **T-12-1731**

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High-Capacity Cylinder

Cylinders featuring unusually large capacity to size ratio and which are designed to deliver considerably improved performance have been introduced by Hanna Engineering Works, 1765 Elston Ave., Chicago 22, Ill.

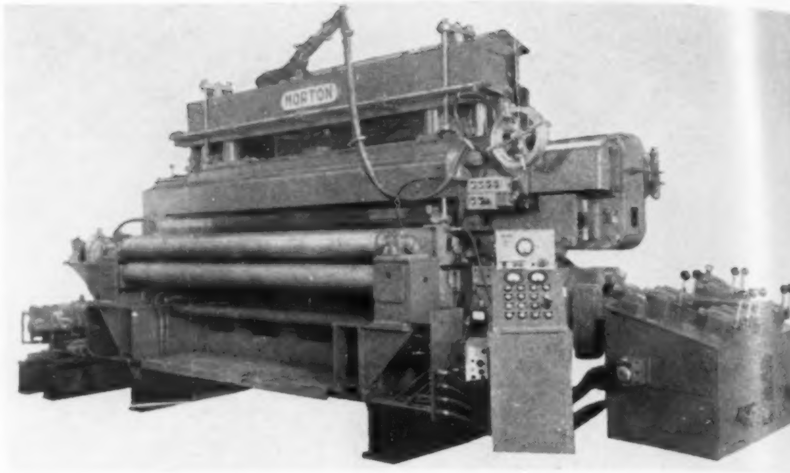
Identified as the 750 series, these cylinders which conform to JIC standards, have been engineered to meet several objectives: To produce a compact cylinder of large capacity with extra broad application possibilities; they incorporate a cushion design with positive, easy adjustment; friction is reduced to a minimum consistent with positive sealing; components are of consistent strength; as nearly as possible they are corrosion resistant throughout.

A catalog completely illustrating the line is available from the company.
T-12-1732

pipe-work, as well as making such joints easy to disassemble without damage when changes are necessary. Due to the extreme lubrication qualities of MoS_2, such joints not only make up tighter with less force required, but can be broken apart, without damage.

The Mo-Silicone vacuum grease is described in technical bulletin 25-A.

T-12-1741



Welding-Trimming Unit

All essential features required for convenient handling of coil ends or flat sheets into position for submerged arc or gas shielded welding are included in the combined welding and trimming machine made by Morton Mfg. Co., Muskegon Heights, Mich. It incorporates the time saving features of welding and trimming the weld bead from both sides, at one time, without unclamping or transferring the welded seam.

It is arranged for welding and trimming 10ft. long seams in 3/16 to 1/4-inch stainless or other alloy sheets and strip. Pinch rolls are furnished, the top roll being hydraulically loaded for holding the sheet flat during welding and trimming operation. A water cooled copper back-up bar is supplied for welding operation. Any number of sheets of any width up to 10 ft. long can be efficiently joined to make a single long sheet.

T-12-1742

Surface Plate Gage

Fast, accurate, surface plate checking of a larger workpiece is provided by a 48-inch model Pla-Chek gage offered by Cadillac Gage Co., Detroit, Mich.

Without the necessity of auxiliary gage blocks, any dimension is established within the 48-inch range in 15 seconds or less, and dimensions are taken directly from the surface plate or from a base line on the work.

Accuracy is assured to 0.0001 inch in any 24-inch length or 0.0002 inch over the entire 48-inch range of the measuring bar. The bar itself is not touched by hand and is unaffected by body heat.

Heart of the self-contained gage is a deep-frozen, stain-free steel alloy bar. At the top of the bar a large micrometer thimble graduated to 0.0001 inch provides intermediate dimensions between the bar's 1-inch steps. With use of a reverse checking plate, a height gage indicator is easily set for checking the underside of workpieces. Use of inside micrometers, telescoping gages and internal cylinder gages is provided by settings between the reverse checking block and gaging button on the base.

T-12-1743

THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Literature Number	COMPANY	DESCRIPTION
A-12-256	Allegheny Ludlum Steel Corp.	**High-Speed Steel Punches**—Thirty-six page book analyzes and compares all A-L grades: carbon, high-speed, cast alloy and carbides. Includes data on handling and treatment for production men. (Page 256)
A-12-16	Allen Mfg. Co.	**Setscrews**—New technical brochure contains results of comparative setscrew tests. (Page 16)
A-12-183	B. C. Ames Co.	**Dial Indicators**—Ames catalog contains information on dial indicators and gages. (Page 183)
A-12-205	F. E. Anderson Oil Co., Inc.	**Coolants**—Leaflet, "Case Histories of Lusol at Work" contains case histories and other data. (Page 205)
A-12-201	Anker-Holth, Div. The Wellman Engineering Co.	**Power Cylinders**—Bulletin discusses the complete line of Anker-Holth products. (Page 201)
A-12-67	W. F. & John Barnes Co.	**Special Machinery**—Booklet, "Coordinated Machine Engineering," describes the scope of Barnes machine tool building service. (Pages 66-67)
A-12-209	The Barry Corp.	**Machine Mounts**—Booklet describes how Barrymounts can save users money. (Page 209)
A-12-62	Beaver Tool and Engineering Corp.	**Toolholders and Adaptors**—Catalog 52 discusses and illustrates a complete line of Beaver Quick-Change tools. (Page 62)
A-12-41	The Bodine Corp.	**Special Machinery**—Brochure TE-12 gives 12 case histories of users. (Page 41)
A-12-255	Carboloy Dept. of General Electric Co.	**Carbide Die Components**—Carboloy Die Engineering Manual gives complete information of Carboloy die products. (Page 255)
A-12-64	The Carlton Machine Tool Co.	**Radial Drills**—Bulletin describes advantages and features of Carlton radial drills. (Page 64)
A-12-33	The Cincinnati Shaper Co.	**Shears**—Catalog S-6 tells of the advantages of Cincinnati shears. (Pages 32-33)
A-12-37	The Cleveland Twist Drill Co.	**Carbide Tools**—Colored, illustrated booklet points out the advantages of Cleveland carbide-tipped tools. (Page 37)
A-12-237	The Cushman Chuck Co.	**Chucks**—Catalog PO-64-1953 describes Cushman air-operated chucks, cylinders and accessory equipment. (Page 237)
A-12-199	Dearborn Gage Co.	**Gage Blocks**—New standards catalog contains specifications and prices in tabular form. (Page 199)
A-12-56	The Denison Engineering Co.	**Oil Flow Controls**—Bulletins contain information about Denison Multi-Range Flow Controls. (Page 56)
A-12-283	Detroit Tap & Tool Co.	**Thread Gages**—Catalog-price list SG-53 covers standard thread gages. (Page 283)
A-12-53	Dumore Precision Tools	**Automatic Drill Units**—Detailed advantages of Dumore tools are given in new bulletin. (Pages 52-53)
A-12-193	Edlund Machinery Co.	**Drilling and Tapping Machines**—Colored, illustrated bulletin No. 140 describes the Edlund 2F. (Page 193)
A-12-50	Erickson Tool Co.	**Indexers**—Catalog K contains applications for all Erickson holding tools. (Page 50)
A-12-186	Ettco Tool Co., Inc.	**Tapping Machine**—Description and advantages of "Unit Engineered" machine are given in bulletin 72A. (Page 186)
A-12-48	The Fellows Gear Shaper Co.	**Gear Shapers**—How to economically utilize the Fellows method is explained in "The Art of Generating with a Reciprocating Tool." (Page 48)
A-12-27	Frauenthal Div. Kaydon Engineering Corp.	**Turning and Grinding Machine**—Booklet describes how the 3100 series precision turning and grinding machine can give high production. (Pages 26-27)
A-12-5	Hardinge Brothers, Inc.	**Variable Speed Machine**—Bulletin DSM59 illustrates and describes advantages of new second operation machine. (Page 5)
A-12-58	Haynes Stellite Co.	**Cutting Tools**—A complete description of properties, sizes, and recommended operating data are contained in "Haynes Stellite Metal-Cutting Tools." (Page 58)

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TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Literature Number	COMPANY	DESCRIPTION
A-12-202	The B. Jahn Mfg. Co.	**Dies**—Detailed descriptions of Jahn dies are contained in "Story of B. Jahn Production-proved Dies."
A-12-189	Lamina Dies and Tools, Inc.	**Tools and Dies**—Twelve-page catalog features Lamina guide bushings and guide pins. (Page 189)
A-12-11	Landis Machine Co.	**Threading Equipment**—Information and specifications for Landis threaders are contained in illustrated bulletins F-80 and F-90. (Pages 10-11)
A-12-23	The Lapointe Machine Tool Co.	**Broaches**—Bulletin TBA-DRV-5 gives a case history of a vertical broaching operation. (Page 23)
A-12-287	Lempco Products, Inc.	**Die Sets**—A new 7th edition catalog and latest price list are obtainable on request. (Page 287)
A-12-226-2	F. J. Littell Machine Co.	**Automatic Roll Feeds**—Production economies and a description of types and sizes of roll feeds are discussed in catalog. (Page 226)
A-12-194	Lovejoy Tool Co., Inc.	**Special Mill Cutters**—Catalog describes the complete line of Lovejoy Cutters. (Page 194)
A-12-272	P. R. Mallory & Co., Inc.	**Boring Bars**—Technical bulletin gives full data on how to utilize chatterless boring bars. (Page 272)
A-12-162	Melin Tool Co., Inc.	**End Mills**—Catalog 54-C lists the specifications on stub length tools and tells how they offer greater strength and less breakage. (Page 162)
A-12-57	National Broach & Machine Co.	**Gear Shaving Cutters**—Contained in Chapter 2, "Modern Methods of Gear Manufacture" are advantages for users of shaving cutters. (Page 57)
A-12-69	Niagara Machine & Tool Works	**Press Brakes**—Bulletin 89C is a comprehensive discussion of all-steel press brakes. (Pages 68-69)
A-12-181	Oakite Products, Inc.	**Painting Techniques**—Booklet "How to Strip Paint" describes strip painting techniques. (Page 181)
A-12-197	The Parker Stamp Works, Inc.	**Stamp Sets**—"Marking Tools" gives the answers to industrial marking problems. (Page 197)
A-12-179	Reid Brothers Co., Inc.	**Surface Grinders**—Bulletin 618-15 gives the full story on Reid Surface Grinders. (Page 179)
A-12-166	Ring Punch & Die Co.	**Punches and Dies**—New 20-page, illustrated catalog gives the complete line of perforating products. Detailed dimensions and prices for each size are given. (Page 166)
A-12-47	Rivett Lathe & Grinder, Inc.	**Air Cylinders**—Catalog section 55 describes construction and seven standard mountings of Rivett cylinders. (Page 47)
A-12-BC	The Sheffield Corp.	**Ultrasonic Machine Tool**—Cavitron data CAV-154 gives detailed information of new process for machining hard materials. (Back Cover)
A-12-182	Sheldon Machine Co., Inc.	**Lathes**—A description of Sheldon Precision Lathes is given in Catalog 29. (Page 182)
A-12-210	J. K. Smit & Sons, Inc.	**Diamond Wheels**—Advantages of diamond wheels are discussed in Catalog 54. (Page 210)
A-12-228	The Taft-Peirce Mfg. Co.	**Air Gages**—Examples of and complete story of Taft-Peirce CompAIRator air gages are contained in bulletin. (Page 228)
A-12-178	The Tomkins-Johnson Co.	**Milling Cutters**—Wide range of styles and sizes of milling cutters for machining tough materials is described in catalog 4-153 (Page 178)
A-12-38	The Torrington Co.	**Swagers**—Catalog gives case histories of users of Torrington swaging machines. (Page 38)
A-12-223	U. S. Tool Co., Inc.	**Pressroom Equipment**—Bulletin 80-T gives facts about the complete line of press equipment. (Page 223)
A-12-42	The Van Keuren Co.	**Optical Flats**—Catalog and Handbook No. 35 describe the accuracies and advantages of fused quartz optical flats. (Page 42)
A-12-276	Wales-Strippit Corp.	**Hole-Punching and Notching Equipment**—Notching and punching facts are given in Wales-BL catalog. (Page 276)
A-12-43	Wesson Co.	**Tool Wedges**—How the Wesson Dual-Wedge lock operates and is applied plus standard sizes available from stock are all contained in Bulletin 1-54-10. (Page 43)
A-12-190	Wheelock, Lovejoy & Co., Inc.	**Bars, Billets and Forging**—Data sheets contain complete technical information on grades, applications, physical properties, tests, heat treating, etc. (Page 190)

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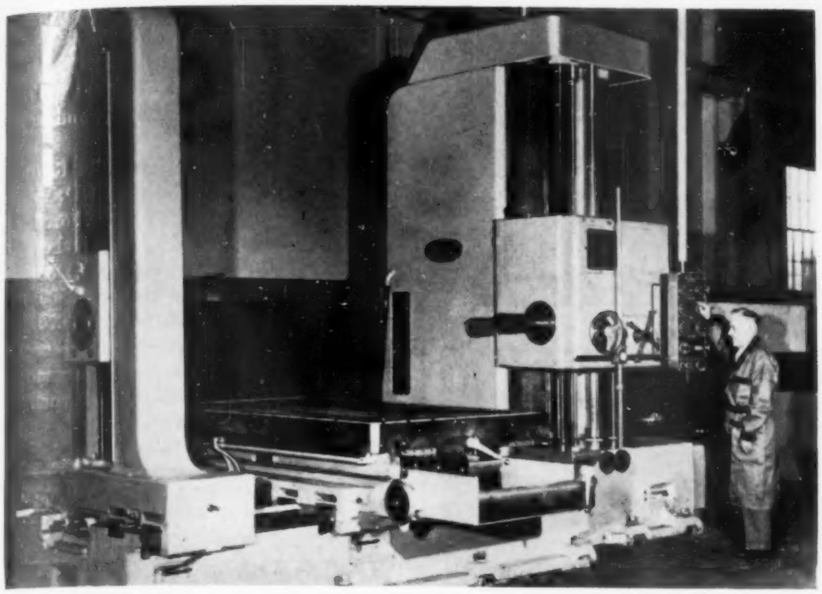


Horizontal Unit for Boring, Milling, Drilling

The Bullard Co., 286 Canfield Ave., Bridgeport 2, Conn., has introduced a newly designed line of table type horizontal boring, milling and drilling machines. Outstanding feature of the units is that all functional controls are operated by toggle-like levers (replacing the usual push-button system), centralized on a movable pendant station. The controls include directional feed and traverse control of the spindle, head, table and saddle, selection of speed feed and speed rates, spindle direction of rotation and head binders. Feed and traverse motion duplicate the direction in which the operator turns the levers.

A second development in the design is the inclusion of both a screw and a rack feed for the spindle, a double arrangement permitting smooth, steady power feed for boring and a sensitive hand feed action for small drilling and tapping. A selector switch on the front of the head determines the type of feed desired.

The head post and head are heavier and more sturdy than formerly. The head post is a massive box section for the full height, making the head rigid at its highest operating position, resulting in less head deflection, greater ability to absorb shock, and permitting heavy cuts and feeds to be taken with accuracy. An optical measuring device provides the operator with means to quickly and accurately set the head or table to any position.

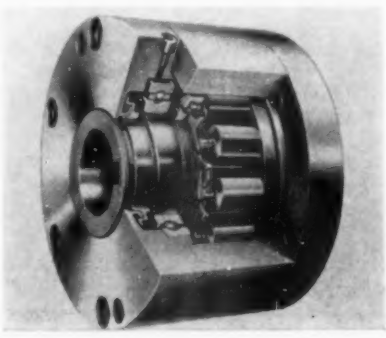
Other features of the unit include feeds in inches per revolution and inches per minute for all motions, automatic depth knockout for spindle, hydraulic counterbalance for head, and massive rear post for supporting extension boring bars. T-12-Y

Cam Clutches for Extra Heavy Duty

Extra heavy-duty ball bearing overrunning clutches for indexing, backstop and general duty machinery applications are available from Morse Chain Co., 7601 Central Ave., Detroit 10, Mich. These clutches, called the K series, incorporate many design features of the former Kelpo overrunning clutches made by Morse.

They have a toothed inner race driving member that actuates closely spaced independently sprung cams. Practical applications for the series K clutches include dual drives, two-speed drives, centrifugal water pump drives, forced and induced fan drives, and ventilating fan drives in heavy industries.

Since tapped holes are provided in both ends of the clutches, a component may be attached to either side of the



clutches, to obtain desired direction of rotation.

The series is made in four standard sizes: K-145, K-150, K-160 and K-175. Each has made-to-order bore and keyway sizes.

Their specifications have the following range: $8\frac{3}{4}$ to 15-inch OD; $6\frac{1}{32}$ to $8\frac{1}{2}$ inches in length; can be bored to fit shafts from up to $2\frac{1}{2}$ to 5 inches in diameter. Torque ratings are: from 1300 to 8000 ft-lb indexing; 2500 to 15,000 ft-lb general duty and 3000 to 20,000 ft-lb backstop. Nominal overruning drag ranges for the four models from 18 to 60 in.-lb at 1750 rpm.

T-12-1781

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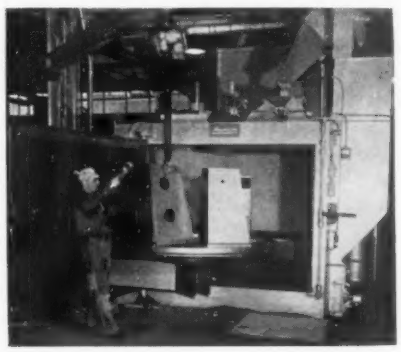
Table-Type Blast Cleaner

American Wheelabrator & Equipment Corp., 1182 So. Byrkit St., Mishawaka, Ind., has announced an unusual table-type airless blasting machine for cleaning and peening applications. This 72-inch Wheelabrator swing table airless blasting machine is built for floor level installation and requires no pit for the abrasive hopper.

Its 40-inch work height clearance permits handling of a wide range of work. Important feature of the unit is the 72-inch diameter plain worktable mounted on the door of the machine so



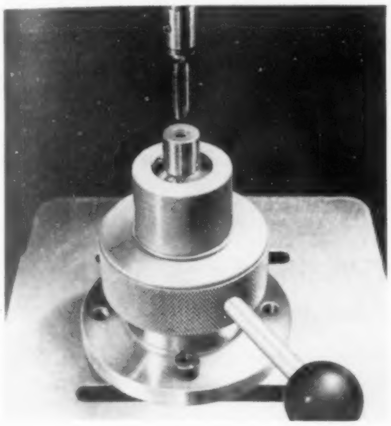
when the door is opened, the worktable comes out into the room for ease in loading and unloading. When the door is shut, the table automatically moves into the blasting zone of the machine and rotates the work under the abrasive blasts from a rotating, bladed wheel mounted in the cabinet roof. Centrifugal force alone propels the abrasive, with no compressed air needed. Blasting is automatic, and the operator never needs to enter the cabinet.

Special vestibules are available in the walls of the machine so that it can take long pieces. **T-12-1782**

Chuck for Small Lathes

Regal Products, 88 Union St., Mineola, L. I., N. Y., has introduced a collet chuck which has a maximum one-inch capacity and uses standard 5C collets. It can be used on small lathes, and it permits full spindle capacity of these machines.

Features in the design of this Regal 5C collet chuck make it as concentric as the bearing of the lathe or machine. It avoids errors of the spindle and collet sleeve, while applying greater holding pressure. The Regal 5C can also be used as a holding fixture on drill presses, horizontal and vertical milling machines, jig borers, etc. **T-12-1791**



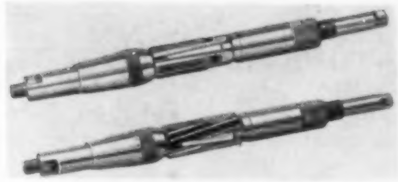
Automation for Punches

A hydraulically driven feeding and straightening machine for quickly converting a manually operated punch press to automatic operation has been announced by the F. J. Littell Machine Co., 4127 N. Ravenswood Ave., Chicago 13, Ill. As a further advantage, the unit can be moved from one punch press to another by means of a fork truck.

This straightening machine, known as the 418-HRP, will handle stock up to 0.125 inch thick. Three sizes of units having roll widths of 12½, 18½ and 24½ inches are available. A wide range of feeding speed selectivity properly synchronizes feeding and punching productions. **T-12-1792**

Expansion Reamer and Hone

The Reasor expansion reamer and hone introduced by Reasor Mfg. Co., St. Charles, Ill., utilizes a 2-piece Sure-Lock sleeve and 2-piece taper bushing sleeve to stop blade movement and assure concentricity. The sleeves work together to give a solid, positive control grip on the cutting blades. The new sleeves fit close to the reamer body and prohibit blade distortion. Adjusting nuts give easy and firm setting.



In addition, Counterboard taper bushings operate closer to blade edges and provide true alignment of the work.

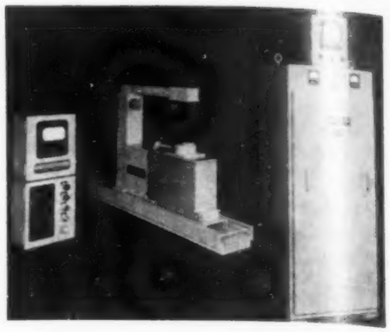
With interchangeable blades, this expansion reamer and hone makes pos-

sible one tool for both reaming and honing, a feature aimed to save time and labor, simplify operation, cut costs and speed production.

It permits an unlimited range of size adjustments, with 0.057 expansion in each set of blades.

A circular, "7 Times Greater Expansion," containing illustrated descriptions, suggested uses, sizes, prices and information on factory blade resharpening service, is available from the company. T-12-1801

Strip Thickness Control



Automatic regulation of the thickness of metallic strip leaving cold reduction mills can be done with a device introduced by the Sheffield Corp., Dayton, Ohio at the recent Iron and Steel Show.

This sizing control has been designed to operate in conjunction with Sheffield Measuray and X-ray thickness gage. In use, the operator simply sets the dials on the Measuray control cabinet to the required thickness.

The control automatically regulates the screwdowns on the mill. Whenever the strip thickness varies from that set by the operator, the screwdowns on the mill will either raise or lower depending on whether the strip is too thin or too thick. A part of the system includes controls that anticipate whether the screwdowns need adjusting either up or down. This feature avoids either hunting or over correction, and thus closer tolerances are held than were previously possible. T-12-1802

Grinding Segment Adhesive

Grinding segments can be reclaimed in a user's own plant by means of an adhesive recently developed by Chemical Development Corp., Danvers, Mass. The substance offers a very simple, low-cost method of salvaging segments. All but the original setup time can be eliminated.

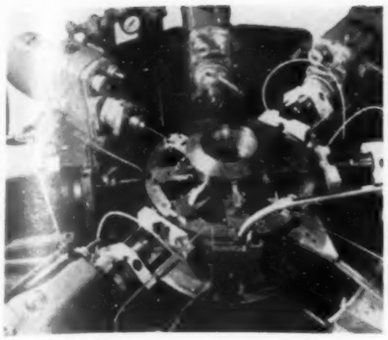
Called Gaff Bond 334, it is simply applied to the surface of the stones. The segments are clamped together with two C clamps for 48 hours, and then returned to the grinder for reuse. No heat or pressure is required. The process can be continued indefinitely with no segment loss.

The cemented joint does not interfere in any way with grinding. In addition, segments have been successfully tested on production items at four times normal down-feed. T-12-1803

Drill Unit Accessory

The Drill Unit Div. of Rockwell Mfg. Co., 434 N. Lexington Ave., Pittsburgh 8, Pa., has introduced a line of sliding sub-bases as an accessory for increasing the versatility of its standard air-hydraulic drill units.

These three bases, one for each size unit, are a step toward standardization of certain elements of special-purpose machines in order to reduce cost. With these bases it is possible for special-purpose machines incorporating Rockwell drill units to be built in such a way



that the units themselves can be moved forward or back with relation to the parent machine without loss of machine alignment.

This feature facilitates removal and replacement of tools, and also saves time and effort in making setup adjustments where the machine is designed for work on a wide range of part sizes. These adjustments can be made without disrupting accurate machine alignment.

Adequate length of travel is allowed for in each of the three sub-base models: 4½ in. for the small model, and 6 in. for the two larger sizes. **T-12-1811**

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Magnetic Drill Press

Metal drilling operations at difficult angles are now only a one-man job with the Bux magnetic press developed by the Buck Mfg. Co., 100 Cypress Ave., Los Gatos, Calif. This equipment also is designed for easier drilling, reaming, tapping and countersinking of structural shapes, bar stock, machinery, jigs and fixtures.

Magnetic pull is over 800 lb, yet it weighs only 34 lb. Recent tests indicate that the Bux model L-2 (shown here), equipped with a ⅝-inch heavy duty drill, can produce up to ¾-inch holes in a 2-inch steel plate without a pilot hole. With a ⅜-inch pilot hole, sizes up to 1¼ inches can be attained.
T-12-1812

Nickel Alloy Cast Iron

Bulletin A-115 offers extensive engineering information covering heat treatment fundamentals of nickel alloy cast irons and utilization of such knowledge to increase usefulness of cast irons; includes charts and tables; glossary of pertinent terms. The International Nickel Co., Inc. 67 Wall St., New York 5, N.Y. **L-12-1**

Valves

General information concerning line of manual and solenoid valves for hydraulic or pneumatic control covered in illustrated catalog 4G; includes detailed descriptions, illustrates the Shear-Seal principle and its application; offers selection chart based on users' requirements. Barksdale Valves, 5125 Alcoa, Los Angeles, Calif. **L-12-2**

Alloy Steel

Bulletin 14-5 deals with Rycut 40, a faster machining alloy steel; covers its advantages, gives case studies showing machining comparisons, production rates and savings gained. Joseph T. Ryerson & Son, Inc., Box 8000-A, Chicago 80, Ill. L-12-3

Rotary Table

Eight-page illustrated booklet, Form RT2, covers construction features, various applications and accessories for company's new 11-in. rotary table emphasizing accuracy and other advantages. Request on company letterhead directly to Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.

Forging

Informative 16-page "Manual of Forging Design" offered to those interested in design of drop, upset and press forgings; includes discussion of purpose, tools and economy tips; illustrated. Globe Forge, Inc., Syracuse 1, N.Y. L-12-4

Testing, Measuring

General bulletin 19-F covers line of instruments for testing and measurement; offers illustrations and specifications of each model plus variety of accessories. W. C. Dillon & Co., Inc., P. O. Box 3008, Van Nuys, Calif. L-12-5

Metal Quenching

Twenty-four page booklet contains information on quenching of metals; illustrated with charts and graphs showing cooling curves, rates, bath temperature effects, hardness penetration curves, agitation curves and transformation diagrams; case histories give details of various problems and their solutions. Gulf Oil Corp.-Gulf Refining Co., 1822 Gulf Bldg., Pittsburgh 30, Pa. L-12-6

Electronic Metalworking

Fact file on Electronic Machining and Grinding explains process in eight individual bulletins; include details on how it works, cost analysis of difficult jobs, converting to electronic grinding, case history studies on difficult die jobs. Elox Corp. of Michigan, 740 N. Rochester Rd., Clawson, Mich. **L-12-7**

Turret Lathe Tools

Extensively illustrated 197-page Turret Tool Lathe Catalog, seventh addition, lists company's complete line of standard tools, chucks, collets and miscellaneous equipment. Explains how each tool works, jobs for which it can be used, and gives specification data. Includes informative data on chucking and bar equipment setup plus offering engineering tables. Request only on company letterhead direct to Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, Ohio.

Wheel Grinders

Illustrated brochure P-54 describes company's 10 and 14 in. Type H-IW multiple wheel precision grinders for grinding diameters simultaneously; shows 12 different tooling setups for various shafts; includes specifications. Landis Tool Co., Waynesboro, Pa.
L-12-8

Welding

Eight-page booklet, "How to Overcome Your Welding Problems and Improve Your Welding Techniques," designed to aid weldors in increasing their welding knowledge and in improving their skill. Eutectic Welding Alloys Corp., 40-40 172 St., Flushing, N.Y. L-12-9

Investment Casting

Simple, easy to understand explanation of the lost wax process presented in 20-page illustrated booklet "Investment Castings—Basic Design Factors for the Engineer." Covers limitations, sizes and weights of parts supplied, tolerances, holes, slots and surfaces, castable materials and pitfalls; also compares investment casting with other processes, including costs and applications. Scott Casting & Mfg. Co., 116 W. Lancaster Ave., Berwyn, Pa. L-12-10

Lathes

Machining for Profit is theme of 12-page illustrated catalog 918-SLB describing Steelway precision cabinet lathe; outlines features of design, advantages of use in production operations, accessories and attachments. Rivett Lathe & Grinder, Inc., Brighton 35, Boston, Mass. L-12-11

Screw Holding Accessories

Magnetic screw holding accessories for power screw drivers and nut setters presented in 24-page manual; includes simplified tables to show how to select proper magnetic driver or finder for specific work; engineering drawings and specifications. Magna Driver Corp., 779 Washington St., Buffalo 3, N.Y. L-12-12

Special Parts
Illustrated 4-page brochure, "Specials for Specialists," describes facilities for producing quantity run shaped and threaded parts to customers' designs by upset and extrusion methods. Cleveland Cap Screw Co., 2917 E. 79th St., Cleveland 4, Ohio. L-12-13

Diamond Grinding
Comprehensive 52-page catalog No. 1233 covers wide line of diamond grinding wheels and hones listing specifications and prices; also includes information on diamond wheel markings, wheel selection, standard shapes of wheels and suggestions for uses. Norton Co., Worcester, Mass. L-12-14

Air Vises
Folder describes company's air powered vises stressing versatility, economy of time for production holding and pressing jobs; illustrated to show usefullness, describes advantages of special jaw faces, unusual mountings and use of multiple vises operating together. Van Products Co., Dept. TE, 3736 W. 12th St., Erie, Pa. L-12-15

Cold Forming
Illustrated 4-page brochure RF-54 discusses "chipless machining" process for cold-forming and the concept behind this Roto-Flo method; covers tooling, results of applications, automation features and design advantages possible through the method. Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich. L-12-16

Production Milling
Illustrated Mill-Matic brochure describes unusual special-purpose automatic production milling machine, discussing its hydraulic operation, special features and advantages. The Producto Machine Co., 990 Housatonic Ave., Bridgeport 1, Conn. L-12-17

Rotary Swaging
In addition to showing line of company's swaging machines with engineering and specification data, edited and revised rotary swager catalog explains swaging in general, its typical uses and operation of equipment involved; die section discusses design and production of the dies. The Torrington Co., Torrington, Conn. L-12-18

Casting Impregnation
Eight-page brochure illustrates modern casting impregnation showing how method achieves its results and equipment used; describes application to various metals. American Metaseal Mfg. Corp., 607 65th St., West New York, N. J. L-12-19

Surface Plates

Formula for surface plate accuracy and outline of simplified method of obtaining it are explained in folder illustrated by drawings. Rahn Granite Surface Plate Co., 635 N. Western Ave., Dayton 7, Ohio. **L-12-20**

Refinishing Stainless

Informative manual covers grinding, sanding, polishing, wicking, buffing and other surface finishing operations for stainless steel; also lists tips for better finishing. Request only on company letterhead direct to R. G. Haskins Co., 2651 W. Harrison St., Chicago 12, Ill.

Industrial Control Counters

Twenty-page booklet offers details on equipment and techniques for controlling industrial equipment with predetermined electronic counters; gives typical applications with diagram illustrations. Potter Instrument Co., 115 Cutter Mill Rd., Great Neck, N. Y. **L-12-21**

Metal Finishing

Brochure 780, "Vacuum Metallizing," fully describes details of technique, applications, advantages and equipment used in this process; also describes and lists specifications for complete range of Stokes vacuum metallizing equipment illustrated. F. J. Stokes Machine Co., 5500 Tabor Rd., Philadelphia 20, Pa. **L-12-22**

High Strength Alloys

Details on high strength heat and corrosion resistant materials called super alloys, presented in brochure including notes on uses and characteristics of various grades, and tables and charts illustrating properties and forms in which they are available. Universal-Cyclops Steel Corp., Dept. 13, Bridgeville, Pa. **L-12-23**

Valves

Sixteen-page bulletin covers line of standard 4-way hand, foot, power and solenoid operated valves as well as company's new line of pilot valves. Gives dimensions and specifications plus application and circuit diagrams. Ledeen Mfg. Co., 1600 So. San Pedro St., Los Angeles 15, Calif. **L-12-24**

Pumps

Entire line of Class KRV and KRVS motorpumps shown in bulletin Form 7074-D made up to provide maximum assistance to user in selecting correct pump for particular purpose; pictorial index also designed for quick reference. Includes graphs and drawings to give engineering information. Ingersoll-Rand Co., 11 Broadway, New York 4, N.Y. **L-12-25**

Men at Work . . .

Two executive appointments at The Gear Grinding Machine Co. involved **Herbert S. Ries** who was elected president of the newly purchased subsidiary Republic Gear Co., and **Edgar D. Leon** who was elected president of the Detroit Bevel Gear Co., also a subsidiary of Gear Grinding. Mr. Leon is also president of Gear Grinding, while Mr. Ries was formerly vice-president and director of sales of Republic.

Raymond A. Vidinghoff, president of Machinery Associates, Inc., was made president of the American Machine Tool Distributors' Assn. when that organization elected officers for the coming year during its thirtieth annual meeting held recently in Cincinnati. Other officers elected include **Henry R. Hanson,** vice-president of Wm. K. Stamets Co., vice-president; **Joseph F. Owens Jr.,** general manager of J. F. Owens Machinery Co., second vice-president; and **Frank Habicht,** vice-president of Marshall & Huschatt Machinery Co., secretary-treasurer. Messrs. Vidinghoff, Hanson and Owens are members of ASTE's Philadelphia, Syracuse and Cleveland chapters respectively.

President of the Clearing Machine Corp., **Rudolph W. Glasner,** has been elected a director and vice-president of Pressed Steel Car Co., Inc., the company which recently acquired Clearing Machine. Mr. Glasner is continuing to manage the operations of Clearing Machine as a division of Pressed Steel Car.

D. Dean McCormick, senior partner of McCormick & Co., has been elected a director of Firth Sterling Inc. He succeeds A. C. Wickman who retired.

American Machine & Foundry Co. have made public the election of Gen. **Walter Bedell Smith** to the office of vice-chairman of its board of directors. Gen. Smith has just retired as Under Secretary of State.

At a recent board of directors meeting of the Logansport Machine Co., Inc., **Mrs. E. P. Wilkinson** resigned as president and was elected chairman of the board. **C. H. Wilkinson** was elected to succeed her in the office of president.

Stephen A. Keller has been named general manager of the Heiland division of Minneapolis-Honeywell Regulator Co. His responsibilities will include all phases of the division's activities, coordinating sales, production and engineering.

Marshall B. Taft now assumes the post of general manager of Minneapolis-Honeywell's Valve division, the position formerly held by Mr. Keller. Mr. Taft previously was assistant to the president of the firm's Industrial division in Philadelphia.

Two appointments recently made at Barry Corp. have moved **Harold Wrigley** to the post of works manager and **Charles S. Basney** to the position of new products manager.

The Denison Engineering Co. has revealed appointment of **Heber L. Newell** as assistant general manager. Previously, Mr. Newell has been general manager of the Barrett-Cravens Co.

Ronald D. Gumbert is now vice-president of the Mercast Corp., affiliate of the Atlas Corp. He remains executive vice-president of Alloy Precision Castings Co.

James H. Moore is now general manager of Vacuum Metals Corp. with offices in Syracuse, N. Y., where all vacuum melting production facilities are to be located.

T. Kenneth Haven has been named vice-president of the Detrex Corp. of Detroit. Until this appointment, he was executive vice-president of Reichhold Chemicals, Inc.

P. F. Brophy has been elected president of The R. W. Cramer Co., Inc. Formerly executive vice-president, he has been associated with the company since 1928.

At the 23rd annual meeting of the Porcelain Enamel Institute **Glenn A. Hutt**, vice-president of Ferro Corp., was elected to serve the Institute as president for a two-year term. Vice-presidents elected included **J. E. Bourland**, Texlite, Inc.; **J. L. Hodgkinson** of U. S. Porcelain Enamel Co.; **D. H. Malcolm** of Armco Steel Corp.; **H. McE. Patton** of Ingram-Richardson Mfg. Co.; **R. N. Smith** of Temco, Inc.; **Y. C. Smith** of AllianceWare, Inc., and **Herbert Turk** of Pemco Corp.

Allis-Chalmers Norwood Works has revealed appointments of **Harry Hoffrogge** as superintendent of machine shops at plant 1 and of **Henry Forbes** to succeed him in his former position as superintendent of manufacturing at plant 2. Mr. Forbes has been general foreman of the Texrope drive manufacturing section at plant 2.

Verson Allsteel Press Co. has made public the appointment of **Paul Kjelstrom** as manager of its Service and Parts Div. Mr. Kjelstrom has been associated with Verson since 1942, most recently as chief engineer, production engineering.

Raymond N. Carlen has been named assistant to the vice-president in charge of operations for Joseph T. Ryerson & Son, Inc. Mr. Carlen formerly was assistant operating superintendent of the Chicago plant.

George J. Zimmerman, formerly chief of the Technical Liaison Div., Office Chief of Engineers, Corps of Engineers of the U. S. Army, has been appointed staff assistant for management controls of The Carborundum Co.

Promotion of **Walter E. Callison** to the post of assistant manager has been announced by the Brehm Die Div. of The Steel Products Engineering Co. The position is a recently created one due to expanding business demands.

Who's Meeti
- and Wher

Nov. 28-Dec. 3. AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual meeting, Statler Hotel, New York City. Complete facts are available from society offices, 29 W. 39th St., New York, N.Y.

Dec. 7-8. THE SOCIETY OF THE PLASTICS INDUSTRY, INC., Fifth film, sheeting and coated fabrics division conference, Hotel Commodore, New York City. Details may be had from society offices, 67 W. 44th St., New York 36, N. Y.

Dec. 12-15. AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. Annual meeting, New Yorker Hotel, New York City. Write for further information to organization offices, 120 E. 41st St., New York 17, N. Y.

Jan. 24-27. PLANT MAINTENANCE & ENGINEERING SHOW. International Amphitheatre, Chicago. For details write to producers of the show, Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

Feb. 8-9. ILLINOIS INSTITUTE OF TECHNOLOGY, Armour Research Foundation, co-sponsors with Chicago section of the American Welding Society. First annual Mid-west welding conference, Institute's Metallurgical and Chemical Engineering Bldg., 10 W. 33rd St., Chicago, to study latest research findings in welding and new welding applications. Direct inquiries to Orville T. Barnett, supervisor of Foundation welding research, Illinois Institute of Technology, Technology Center, 35 W. 33rd St., Chicago 16, Ill.

Feb. 8-10. THE SOCIETY OF THE PLASTICS INDUSTRY, INC. Tenth annual reinforced plastics division conference, Hotel Statler, Los Angeles, Calif. For more details contact society office, 67 W. 44th St., New York 36, N. Y.

Mar. 14-15. STEEL FOUNDERS' SOCIETY OF AMERICA. Annual meeting, Drake Hotel, Chicago. For details write society headquarters, 920 Midland Bldg., Cleveland 15, Ohio.

Mar. 14-18. AMERICAN SOCIETY OF TOOL ENGINEERS. 1955 Western Industrial Exposition, Shrine Auditorium and Exposition Hall, Los Angeles. Annual meeting to run concurrently, Ambassador Hotel and Shrine Auditorium. Complete information available from Society headquarters, 10700 Puritan Ave., Detroit 38, Mich.

Technical Shorts...

Lubricant Substitute

Scientists working at Armour Research Foundation of Illinois Institute of Technology, under a program sponsored by the American Iron and Steel Institute, have created an acceptable domestic substitute for palm oil, now used as a lubricant in cold rolling steel. This substitute, based on animal fat materials, has been proved to be both adequate and economical. Source for the new lubricant is tallows which are readily available and in sufficient quantities from meat-packing concerns. The tallows can be processed into a lubricant usable by the steel industry in cold rolling operations.

Currently, palm oil, an abstract from palm nuts, must be imported from Africa and the West Indies. During the second world war shipping lanes were threatened and caused concern over possible curtailment of palm oil supplies. Fear that another emergency might cut off entirely the supply of palm oil gave impetus to the search for a substitute.

* * *

Device Predicts New Tool Effects

Engineers are going to be able to estimate in advance effect of the addition of new equipment to an industrial operation without test installing it. Aid to such prediction is the electronic testing system developed by Minneapolis-Honeywell Regulator Co.'s Industrial Div. The unit, called the servo analyzer, was unveiled to the profession at the recent First International Instrument Congress and Exposition. It first automatically translates behavior characteristics of equipment to a chart record. This is then analyzed to determine how such a component will affect over-all behavior of the operation.

In actual operation, a single or group of controls are checked by the new system to verify their correct performance. This is accomplished by automatically introducing an electronic rhythm similar to alternating current into a process. The servo analyzer automatically measures and plots the effects. The whole test can be completed and recorded in as little as eight minutes.

Four components make up the portable system—generator, portable potentiometer, control box and function plotter—and three forms of test energy—pneumatic, mechanical and electrical—are provided.

Engineers who designed the unit after some 10,000 man-hours of research estimate that it can save from 30 to 60 percent of research time involved in redesigning a process. Although first developed to meet their own needs for faster methods of equipment analysis, it now is being made available to industry.

* * *

Heat for Titanium

Nine seconds is all the time required to heat a $\frac{3}{8}$ in. rod of titanium to 3400 F with the recently introduced high-speed induction heater. Titanium has been considered very difficult to heat with high frequency. However, induction heating can now be used for butt welding titanium rods and also for maintaining desired temperatures in the metal until machining operations

are completed. The unit can accomplish soldering, welding and annealing of more commonly used metals as well in fractions of a second.

Radio Frequency Co., which designed the heater called Model 10,000, describe it as consisting of an induction coil sized to meet job requirements, a 10,000-watt air cooled tube, mica silicone transformers and heavy-duty all aluminum tank capacitor filled with dielectric synthetic Hectranol.

* * *

Rolling Mill For Lab Work

RESEARCH PROGRAMS being carried on with "new" metals particularly may be facilitated by the versatile package rolling mill built by Stanat Mfg. Co. Example of possibilities is the use which is being made of the rolling mill at the Cleveland laboratory of Horizons Inc. where research is being conducted on roll-cladding of titanium on steel. Use of the mill there includes tests to determine effect of roll-surface

finish in hot rolling of aluminum and its alloys; determination of work hardening characteristics and recrystallization temperatures of electrolytic titanium and zirconium; and experimental rolling of sheet and wire.

The mill, though sturdy in construction, is small in size which makes it more practical to use than shutting down production equipment for test work. Equipped with dual heads, it handles experimental ingot, rod, sheet, round and flat wire.

Readers' Viewpoints

. . . chip control

To the Editor:

The article by ten Horn and Schuermann on chip control in your October issue is very timely and appreciated because it touches upon one of the important problems adversely affecting production.

The authors suggest, and I concur, that it is desirable to eliminate chip breakers on tools by selecting the proper ratio of depth of cut to feed which makes the chip self-breaking. They base their presentation on the so-called section ratio which is also known as the chip shape or the slenderness of the chip (defined by my articles "Machining with Single-Point Tools," THE TOOL ENGINEER, Jan. and Feb. 1940 and "Fundamentals of Metal Cutting Science," *Grundzuege der Zerspanugslehre*, 2nd Edition, Springer Verlag, Berlin 1954). The greater the depth of cut with respect to feed, the more slender the chip.

However, the shape of the chip affects not only the chip-breaking characteristics but also tool life and cutting force! These must therefore be taken into consideration when selecting the cutting conditions for breaking chips. In my research it was found that a change in the slenderness of a chip of a given coss-sectional area by increasing the feed and decreasing the depth of cut while keeping the area constant, has opposite effects on tool life and cutting force. The cutting force per unit area is reduced, which is desirable but the tool life is likewise reduced which is undesirable. As an example, changing a chip of 0.001 sq inch cross-sectional area from a shape of 20.1 to 5:1 causes a drop in tool life of 18 percent in the case of machining steel. The unit cutting force would drop 20 percent in this example.

The recommendation given by the authors to use thick and relatively shallow chips for obtaining self-breaking chips, must therefore be restricted by considerations of tool life because a self-breaking chip is usually associated with poorer tool life. Many tool engineers, however, might prefer a slight reduction in tool life if they can have short breaking chips and save down time for removing snarly chips from the machines. The reduction in tool life can often be more than compensated in this way.

Other conclusions offered by the authors are confirmed by my research. An analysis of the chip shapes employed in American industry revealed the following data:

Slenderness of Chip (ratio of depth of feed)	Frequency of Occurrence in practice (%)
Less than 2:1	5
2:1 to 4:1	25
4:1 to 10:1	48
10:1 to 20:1	20
20:1 or greater	2

More chips have a ratio of 5:1 than of any other single ratio (12½%) and this chip shape has therefore been selected as a reference chip for the derivation of metal-cutting formulas, *Fig.* 9 of the authors' paper shows also that chip shapes between 4:1 and 10:1 occur most frequently. If the chip shape of 5:1 would be adopted as an international reference standard for tool life, cutting force data, etc., it would also be possible to refer chip fracturing characteristics to it and simplify the comparison of data and the recommendations for other chip shapes.

The authors, however, have not changed the tool configuration and also have not considered the effects of tool geometry and vibration on chip formation. The effect of changing the true rake and the angle of inclination should be taken into consideration (as indicated in my article "The Inclination of the Cutting Edge and its Relation to Chip Curlings," THE TOOL ENGINEER, March 1945).

Furthermore, chip formation also de-

pends on the elasticity of the system—workpiece, tool and machine. With the same tool, feed, depth of cut, etc., chip formation changes when the elasticity or the vibratory characteristics change with respect to the workpiece, the tool or the machine. It is therefore believed that the change in chip-breaking characteristics with change in work diameter as reported by the authors is due to a change in the elasticity of the workpiece.

The authors and editor are to be commended for the presentation of this article which has shed considerable new light on an important tool engineering problem.

M. Kronenberg
Consulting Engineer
Cincinnati, Ohio

To the Editor

In the excellent and thought-provoking article "Chip Control" by ten Horn and Schuermann, October, 1954, the authors have very kindly attributed the formula for bulk ration R to me.

This is undeserved. The formula is quite commonly used in German literature, and it seems that it was first introduced by H. Schallbroch and R. Wallichs.

The snarling chip is included in the very comprehensive Chip Classification Table (Spanbeschreibungstafel) by Schallbroch, under the name of "Wirrspan."

Erik K. Henriksen
Department of Mechanical Engr.
University of Missouri
Columbia, Missouri

To the Editor:

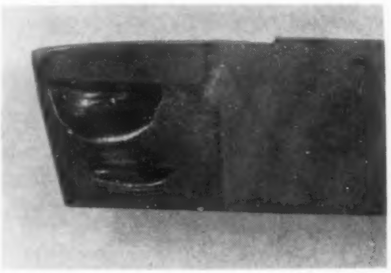
It was interesting to see the results of an organized approach such as Messrs. B. L. ten Horn and R. A. Schuermann took to continuous breaking of chips without grinding a step type chip breaker on a tool, but through the variation of feed and depth.

We have had a fair degree of success with this approach when using solid insert tools having negative 7-deg back rake and negative 7-deg side rake which have a greater tendency to curl the chip back against the work and break it than the positive rake tools. The major problem experienced in this method has been the high horsepower output required of the motor to take feeds heavy enough to cause the chip to break up. The horsepower which the motor on the lathe was required to develop in obtaining the data represented in *Fig.* 5 of this article was quite high in many cases. Machining medium-carbon steel (45-percent carbon) at 500 fpm, 0.040-inch depth of cut and 0.023-ipr feed required only around 5-motor

horsepower but at 0.100-inch depth of cut and 0.026-ipr feed, the motor horsepower would be around 14 horsepower. These were for tools which were sharp. When the cutting edge is worn, horsepower about doubles or about 28 horsepower for 0.100-inch depth of cut. At the heaviest depth listed, 0.200-inch depth of cut at 0.035-ipr feed, the motor horsepower for sharp tools is around 35 and had the tools been used to the regrind point, 70 horsepower would have been required.

Although these cuts are permissible on the more modern type of machine tools, most equipment taking depths in the range of 0.100 to 0.200 inch do not have sufficient horsepower available or the rigidity necessary. Experience has indicated that at lower speeds requiring lower horsepower, heavier feeds are required to break the chip. Evaluation of the effect of speed on Messrs. ten Horn and Schuermann's works might enable us to use the slower speeds and thus apply this approach to the older type lathes. Carboloy's newly developed grade 370 carbide is designed to give good tool life at these lower speeds and extremely heavy feeds and depths.

Proof of the existence of a "point of guidance" or point where the chip runs into the tool and breaks itself is shown in the accompanying illustration. A



large quantity of the shank material has been worn away from beneath the carbide tip by the erosive action of the chip breaking itself against the shank. If this condition is encountered, cutting conditions should be modified to change the direction of the chip flow or else the resulting lack of support may cause failure of the tool.

H. Jack Siekmann
Engineer
Carboloy Department
General Electric Company

To the Editor:

I have read the article "Chip Control —How to Determine Tool Feed to Obtain Desirable Chip Form" by B. L. tenHorn and R. A. Schuermann, as published in the October issue. I am glad to see you publish articles of this type.

The suggestion of the authors that the chip be controlled by increasing the feed rate has several good advantages. Increasing the feed will increase the production rate and even though the cutting speed may have to be reduced, the volume of metal removed per minute will be increased. Production rates would automatically be increased if machine operators would use this method of chip control. However, the heavy feed rates which must be used to control the chips for alloy steels often will overload the machine or produce a poor surface finish and in this case a conventional chip breaker must be used.

The suggestion of the authors that the critical feed be used as a criterion of machinability is apt to cause a misunderstanding of the basic machining properties. If this method were used, it would indicate that the feed rates should be smaller when cutting free cutting steels than for cutting normal alloy steels. This is just the reverse of what should be used, since it is possible to use much higher feed rates when cutting the free cutting steels because they require less power and produce better surface finish.

W. W. Gilbert
Mfg. Consultant
General Electric Co.
Schenectady, N. Y.

abstracts of FOREIGN LITERATURE

By M. Kronenberg
Consulting Engineer

Milan Machine Tool Exhibition

Reports indicate that the German machine tool industry had extensive exhibits. Many other European countries participated. American machine tool makers were well represented.

K. Schroedter in Issue No. 9 of *Werkstatt und Betrieb* surveys German machine tool exhibits. He outlines progress made during the past year, that is, since the machine tool show held in Belgium in 1953. He reports that the German machine tool industry is working toward improvements in guideways, simplification of operation, higher rigidity, wear reduction, more accurate measuring equipment for the setting of the machines and for dimensional accuracy.

Eduard Henrion describes Belgian machine tool exhibits. He likewise notes a tendency to increase rigidity and to reduce machining and handling time by working toward automation, introduction of electronic equipment and to improve accuracy. Combination machines made in Belgium included a combined tool and surface grinder and a new duplex planing and milling machine with three adjustable milling heads. Special boring machines for jig and fixtures were on exhibit as well as numerous other machines with program control, hydraulic profiling attachments and the like.

Comments on American machine tools state: "While the European designer, confined to narrow space, thinks in terms of versatility and tries to adapt his machines to as many purposes as possible, the American, favored by huge spaces and greater quantity production, is able to employ special machines and automatics. For this reason extended automation and the acceleration in the sequence of operations take first place abroad. The trend toward greater rigidity and adaption to the cutting capacity of carbide tools is likewise noticeable in the machines exhibited by American machine tool manufacturers."

Austrian machine tools included lathes of high accuracy, according to a report by J. Zeman in the same issue of *Werkstatt und Betrieb*. There were also precision boring mills for rear axle housings, pipe forging machines and others attaining accuracies close to those obtained by metal-cutting machines.

Swiss machine tools at the exhibit are described in the magazine *Technica*—Bern, where F. Pohl gives an account of progress there. This article is illustrated with photographs of machines and also includes sections through important parts as well as calculations of the production time of various items. The advent of a machine tool industry in Holland is discussed in an article in another issue of *Technica* by W. A. Loewenthal. Although the first lathe made in Holland is only 13 years old, a rapid development has taken place there since 1941 so that the production includes now milling machines, shapers, toolroom grinders and universal grinding machines made by about ten different companies.

Plain Bearings for Machine Tools

Surface finish and dimensional accuracy are greatly affected by the main spindle bearing in precision lathes, precision boring machines, precision milling machines and grinding machines and for this reason plain bearings are gaining new ground according to an article by M. Hirschfeld published in No. 8 of *Konstruktion*, 1954.

The author claims that chatter marks on workpieces, which correspond to a roughness of less than 0.00002 inch, cannot be avoided with antifriction bearings due to metal to metal contact. Plain bearings, on the other hand, produce a better surface due to the damping properties of the oil film. Journal bearings, however, are usually not accurate enough to permit the formation of an uninterrupted oil film, as necessary for the stability of the rotating shaft. The oil film must not exceed a thickness of 0.0001 inch in the high pressure region in order to support the load; such dimension requires a very smooth surface in the bearing which is expensive to produce.

For a long time the journal bearings could not satisfy therefore the accuracy requirements of precision machine tools until the multiple surface bearings were developed. Among these the rocker shoe bearing, the Mackensen bearing and the Kingsbury bearing were the best-known types. Recent developments are described by the author, such as the new Mackensen bearing employing a three-point contact bushing, which is deformed elastically under

the oil pressure although it consists of a single piece. The author discusses the MGF bearing, the Lindner bearing for grinding machines, the Studer-bearing developed in Switzerland, the MSO bearing and also the Fluide bearing of French origin.

Cost Analysis of Carbide Grinding

The economics of grinding carbide tools with diamond wheels in comparison with grinding them with silicon carbide wheels has been investigated by J. Witthoff who has published his results in *Krupp Mitteilungen* No. 5, 1954. The investigation deals particularly with cases where heretofore diamond finishing of the carbide tip was considered too expensive. The author has run a great number of tests, determining tool life obtained when the tips were ground with silicon wheels as against finishing the tips afterwards with diamond wheels. The cost of grinding, the value of the new tool and of the used tool were also determined. The higher accuracy of the cutting edge in the case of diamond grinding is due to the fact that the grain is cut while it is torn out of the carbide when a silicon wheel is used.

All tests were run on steel and included workpieces and operations of various types, such as roughing, finishing, copying of shafts, locomotive axles and others. The comparison covered dry and wet grinding with diamond wheels and silicon wheels. The cutting speeds were varied from 00 to about 700 fpm. The results indicated savings between 21 and 64 percent in tool cost due to increase in tool life between 24 percent and 115 percent when the carbide tips were diamond ground without a coolant. In the case of grinding with diamond wheels using coolants, the savings were more consistent varying between 52 percent and 65 percent.

Electro-Erosion Machining

A summary of the numerous metal machining processes falling into the category of "electro-erosion" will be found in Issue No. 5, 1954 of *Technische Mitteilungen Krupp*. The article, prepared by J. Hinnueber and O. Ruediger, differentiates between six types of machining methods. The authors discuss the chemical method of depositing metal, the electrolytical method, the use of an electric arc, the spark method in conjunction with a condenser, supersonic metal-cutting and finally drilling with electronic rays.

. . from Russian Publications

by R. Gibson
Asst. Professor of Economics
University of Illinois

The August, 1954 issue of *Voprosy Ekonomiki* (Problems of Economics) describes the application of precision casting to the manufacture of boring mill parts such as gears, taps and keys. Pneumatic apparatus has been introduced for tightening nuts in assembly plants. Bars for dowels and keys are being cold-rolled and bushings are being made by cooling in liquid hydrogen.

A semiautomatic machine has been constructed for hardening tractor crankshaft journals by high-frequency current, and multiple-tool machines have been itroduced for machining the journals. A thread-generating machine has been designed for milling threads to fine precision. on diesel engine valves and semiautomatic machines are being used to grind the valves. Spherical surfaces of turbine bearings are now being ground instead of hand scoured. Profiling machines are being used in the manufacture of interchangeable parts of high precision from a master copy of intricate configuration.

The June issue of *Stanki i Instrument* (Machine Tools and Instrument) publishes photographs of four-spindle and two-spindle models of such profilers. Other machines illustrated in this magazine are: a grinding machine equipped with a stereometer for ob-

serving the precision of its operation, a vertical contour band-sawing machine and a large horizontal lathe for machining rolls for rolling mills.

The July issue of this journal illustrates a four-spindle planer-type milling machine like the one made in the United States by Ingersoll, with two rail heads and two side-heads, and two models like the old vertical turret lathes made by Bullard and King.

The June issue of *Vestnik Machinostroeniia* (Machine-building Review) illustrates and describes a floor-type horizontal boring machine similar to the kind manufactured in this country by Giddings & Lewis and Lucas. Also described is a "straightening" machine similar to the Yoder roll-forming machine.

The July issue of this publication describes a metalworking press for molding metal and ceramic parts, with dies and feeder for measuring the prescribed quantities of metal or ceramics. Photographs are shown of a transfer machine for boring holes in the ends of cylinder blocks, a device for measuring the diameter of bearing races and an automatic machine for sorting piston rings according to outside diameter for selective assembly purposes.

A new cylindrical grinding machine for machining diesel crankshafts is described. It can machine parts as long as 2000 millimeters (about 6½ feet). The grinding wheel is traversed and positioned automatically.

A model of a machine for packing and weighing ice cream into paper or wafer cups is being manufactured. Its productivity of 3600 portions an hour seems rather slow from American standards.

Pravda for June 16, 1954 contains a photograph of an automatic machine for making drinking glasses. From its appearance and the description in the caption it appears to be similar to the American Westlake glass-making machine. It has six sections of four blow molds each. The table revolves continuously. The machine can turn out 26,000 glasses in 24 hours.

Planovoge Khoziaistoo (Planned Economy) for May-June, 1954, in an article on "Problems in the Development of Soviet Machine-building," heralds the wide application of speed-cutting of metal and automatic and semiautomatic electric welding. It is claimed that there has been a 52-percent increase in the past three years in the output of large, heavy metal-cutting lathes, and a doubling of the output of forging and pressing machines. One lathe has been constructed for machining parts of turbines, boilers and generators up to 13 meters (about 14 yards) in diameter.

Field Notes...

Increased prestige of American products plus increased trade abroad is the goal toward which the Department of Commerce is working in its stepped-up program for interesting industrial participation in international trade fairs.

These fairs have become extremely important to foreign countries as a market and show place for the world's goods. Buyers are accustomed to finding sellers there and can contact many in a short time. Exhibitors also promote their products to the public which attends the fairs in unexpected volume up to several millions. As the Department of Commerce points out, most of the world's major trading nations participate in such exhibitions and in general have utilized them to advantage to strengthen the promotional aspect of individual displays with a central exhibit design to draw attention to the total industrial progress and achievements of the nation. American exhibits have been conspicuously absent from these international trade fairs.

In an effort to develop a remedy for this lack of display for foreign attention and to encourage business to take advantage of this means of publicizing the production performance and achievement of our enterprise, the Department is conducting a "Survey of U. S. Company Participation in International Trade Fairs."

This survey is intended to compile and locate companies which are interested in participating in international trade fairs, and such firms are urged to file with the Department or any of its field offices information on the details of their proposed exhibits; specific fairs in which they are interested; types of products and services to be exhibited; and representatives, either at home or aboard, with whom the Department may cooperate.

With this knowledge of American exhibitors' expectations and requirements, the Department looks forward to being able to provide maximum assistance in directing attention toward the exhibitor and the products and services offered. As a second objective, the Department hopes to obtain maximum promotion and publicity for the United States and for American business and products generally.

Copper and Brass Warehouse Assn. executive secretary George W. Proffitt put a crimp in the scare stories about copper shortages by forecasting an increase by one fourth in copper production during the next year or two. He told a meeting of construction industry officials that stories about the shortage which have led some industrial users to search for substitutes are unfounded.

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An award has been established by Worcester Pressed Steel Co. to honor an individual for having done original and outstanding redesign work in the field of metal stamping. Known as the John Woodman Higgins Redesign Award, it will include a cash prize of $500. The first award is to be presented at the spring technical meeting of the Pressed Metal Institute in May of 1955 to the engineer whose entry is judged best on these counts: successful production by metal stamping for a part previously turned out by another metalworking process; originality of design; and significant cost savings realized in the changeover to the metal stamping technique. Closing date is December 31, 1954. Entries should be sent to John Woodman Higgins Redesign Award, Pressed Metal Institute, 2860 E. 130th St., Cleveland 20, Ohio.

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The Aluminum Association has revealed formation of a new division comprised of producers of aluminum rolled bar and rod, and wire. R. W. Goss of Scovill Mfg. Co., will serve as chairman of the new division.

During the association's meeting recently, its members agreed that with present operating capacities domestic production of primary aluminum will approach 1½-million tons this year. Donald M. White, association secretary, stated that there is every indication that civilian users will have even more aluminum in the October-December quarter of 1954 than in any previous quarter.

new endeavors

Help to users of blast cleaning equipment is to be the aim of a new publication, *Wheelabrator Tips*, by American Wheelabrator & Equipment Corp. for quarterly distribution. Primarily, the publication will be concerned with providing helpful suggestions and discussions on better operating methods and better maintenance.

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Production of cemented carbide is now under way in the new plant of Firth-Loach Metals, Inc. at McKeesport, Pa. President of the firm is L. Gerald Firth, who resigned about a year ago as vice-president in charge of research and development of Firth-Stirling, Inc. The firm was formed by Mr. Firth and William J. Loach for the purpose of manufacturing blanks for carbide tools only.

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Official announcement has been made of the formation of a company for the purpose of engineering, manufacturing and sale of induction melting and heating equipment. The company, which will trade under the name Inductotherm Corp., is located at 620 E. Glenolden Ave., Glenolden, Pa.

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Metal bonding adhesives formerly made by ChemoTec Div. of Eutectic Welding Alloys Corp. are now being manufactured, sold and serviced by the Adhesive Div., Polymer Industries, Inc. All inquiries, according to Eutectic, concerning these organic bonding agents should be addressed to the new source.

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Balas Collet Co. has established a new service for machine tool operators on the West Coast. Pick up and shipment of various company products can now be made from either A. C. Behringer, Inc., 334 N. San Pedro St., Los Angeles, or Paul & Dudley, 331 W. Colorado Blvd., Glendale.

purchases

Complete production facilities of the Detroit Die Casting and Plating Co. have been purchased by Bart Manufacturing Corp. Under the new management, the present personnel of the Detroit firm will be augmented by precious metal plating experts. Facilities also are being expanded with the installation of equipment for production of bright gold plating, to specification, on all types of die casting.

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Barber-Colman Co. has purchased the Hendey Machine Co. with the exception of its manufacturing facilities. The acquired firm now is to be known as the Hendey Machine Div. of Bar-

ber-Colman Co. Manufacturing operations are expected to begin at the Barber-Colman plant in Rockford, Ill. shortly after the first of the year. Temporarily parts, sales and service are available through either the parent company's sales organization or the present Hendey sales representatives.

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Clark **Equipment Co.** has announced acquisition of The Torcon Corp.'s inventories engineering designs and products, tooling, trademarks, patents and certain other assets. In the transaction, Clark did not purchase Torcon's capital stock nor assume its liabilities according to company statement.

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All capital stock of the Schneider Mfg. Co. of Muncie, Ind. has been purchased by Westinghouse Electric Corp. The Muncie firm makes torque converters.

new names

New name for the former Ohio Rebuilding Corp. is Lahr Machine & Tool Corp. Reason for the change, according to company president, Edward F. Laumann, is to offer a more accurate label since the company no longer specializes in rebuilding but is primarily engaged in design and manufacture of special machines. The company is located at 1841 Dorr St., Toledo, Ohio.

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Corporate name of the Pressed Steel Car Co., Inc. has been changed to U. S. Industries, Inc. in order to more accurately represent the firm's activities which are now highly diversified.

expansions

Official opening of its welding plant at York, Pa. has been marked by General Electric Co. The plant, which came about after long term planning, is now headquarters for G-E welding products and contains the most up-to-date manufacturing facilities for manufacture of a-c transformer, d-c rectifier, d-c motor-generator and d-c engine welders. The welding department formerly was located at Fitchburg, Mass.

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New quarters have been finished by The Monarch Machine Tool Co. to house a demonstration room roughly three times the size of facilities former-

ly used for the purpose. With the expanded area, each of the machines (fifteen lathes can be accommodated in the new room) will be under power so that it can be readily demonstrated to visitors.

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Welding activities at General Electric Co. have been boosted with completion of a major expansion program for its welding department. The new welding equipment plant at York, Pa. makes possible complete integration of equipment manufacturing operations, including standardization of products and mechanization of many manufacturing procedures.

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Plans to establish a midwestern operation for production of its various lines to serve accounts in the area have been announced by Eastern Metal Products Corp. When completed the plant, located in Fort Smith, Ark., will provide a 350,000 sq ft facility employing about 1200 persons. Approximately one third of the ultimate structure is expected to be ready for production in March of the coming year. Balance of the plant should be ready by the end of 1956.

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Plans for expansion of Towmotor Co. include a 155,000 sq ft plant to house increased production facilities. The new plant will make space available in existing buildings for expanding research and development activities.

moves

The Alpha Corp. has moved to larger quarters at 65 Harvard Ave. in Stamford, Conn. Growth of the company's business in industrial lubricants plus an expansion of activities into basic chemical research in the lubrication field necessitated the change of location.

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Hannifin Corp. has completed its move to the new plant at 501 S. Wolf Rd., in Desplaines, Ill., the final relocation involved only administrative, sales, engineering and office personnel since the main plant had been moved earlier this year.

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New plant to house industrial truck production for The Colson Corp. is under construction in Elyria, Ohio. The 40,000 sq ft structure, which is located only $1\frac{1}{2}$ miles from Colson's main factory, is scheduled for completion before the end of the year.

good reading

CHARACTERISTICS AND APPLICATIONS OF RESISTANCE STRAIN GAGES. *Published by U. S. Department of Commerce, National Bureau of Standards Circular No. 528. Price $1.50. 140 pp.*

Symposium papers are presented in this book which represent some of the latest experimental and theoretical results in the study of resistance strain gages by leading institutions in America and abroad.

Strain gage applications and progress in new work are reported. The new work includes conducting coating applied by an evaporation technique and special temperature compensated gages.

ASME HANDBOOK ON METALS PROPERTIES. *Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price $11. 440 pp.*

This book has been written to satisfy the need for compiled engineering data in one source on metallurgical, physical, fabrication, and mechanical properties of typical metals. In chart and table form are data on over 500 metals in common industrial use.

Tabulated under each of the metals listed is such information as the chemical composition of metals, brittleness, heat treatment, treatment temperatures for forging, annealing and quenching, etc.

A STATISTICAL ANALYSIS IN CHEMISTRY AND THE CHEMICAL INDUSTRY *by Carl A. Bennett and Norman L. Franklin. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City 16, N. Y. Price $8. 724 pp.*

Presented in this book is a mathematically complete development of those aspects of applied mathematical statistics which are most useful to chemists and chemical engineers. Subjects are dealt with as completely as possible and include the theoretical background and derivation of the analytical methods together with computational procedures.

QUALITY-CONTROL HANDBOOK. *Edited by J. M. Juran. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price $12.00. 800 pp.*

A comprehensive picture of quality control is given in this book. How it works from an economic standpoint and six key functions involved in setting up and maintaining a quality-control system are discussed. Illustrative examples from actual cases and records are included.

CUTTING, BLANKING AND DRAWING DIES *by G. Oehler. Published by Springer Verlag 1954, Berlin- Goettingen-Heidelberg, West Germany. Price $9. 488 pp.*

Contained in this book, written in German, are descriptions of latest processes and tools used in sheet metal work. The subject is divided into 12 chapters, the first one dealing with the preparations necessary to start the tool design and followed by a chapter on the design principles for blanking dies. Another chapter brings numerous illustrations of examples of these dies, while other chapters refer to design principles for cutting dies, deep drawing dies, material for dies, heat treatment, grinding of cutting dies, etc. In addition to practical considerations, the theory of stresses and deformations taking place in the sheet metal is also well covered in the book.

MANUAL ON LENGTH MEASUREMENT TECHNIQUES *by Paul Leinweber, G. Berndt and O. Kienzle. Published by Springer Verlag 1954, Berlin- Goettingen- Heidelberg, West Germany. 806 pp.*

This book, written in German, covers the entire technique of measuring length dimensions and angles as occurring in machine shop work and in industrial laboratories. The theoretical section includes definitions of units, measuring errors and their evaluation, mathematics, statistical computations, geometrical and physical fundamentals. A chapter on the physiology of measuring deals with the human senses and the reaction to light with regard to measuring accuracy.

The application section includes a chapter on interchangeability, tolerances, fits, instruments for measuring shafts, diameters, profiles, threads, gears, optical measuring devices, electrical instruments, pneumatic controls, apparatus for measuring surface finish, and deals also with gages and their applications. The international standards for surface roughnesses are discussed in detail, and special techniques are described for measuring the accuracy of antifriction bearings, spline shafts, and numerous other items.

technical digests

How Engineers Become Executives

by J. E. Walters

Prof. of Eng. Admin. Dept.
Rutgers University
New Brunswick, N. J.

Forty Percent of All industrial executives are engineers according to the Engineers' Council for Professional Dev lopment. As early as 1933 it was found that three-fifths of the engineers, 20 years after graduation, were engaged in administrative functions. In spite of this, there is a rather general impression that engineers are poor administrators, because of their interest in machines and physical things. If engineers practiced better engineering administration an l applied engineering principles to it, perhaps a greater percentage would rise fo higher positions in management.

Since the war there has been a shortage of good young management personnel, especially in engineering administration. The demand has grown because many companies are decentralizing management functions requiring better managers and more of them. Increasing complexities of business and industry require better managers today than formerly and this trend will be intensified in the future. Specialization, however, has caused many executives to concentrate on their particular functions, neglecting broader management functions.

Are Managers Different?

Has management as a group different characteristics than those who are not good managers? Evidence seems to show management is distinct or different. For example, Sears Roebuck and Co. compared results obtained by 68 persons who had been released from their executive development program with results obtained from those who had been outstanding on that program. All were given a number of personality tests. As shown in *Fig.* 1, statistical comparison brought out significant differences.

Personnel Administration at Executive Level

A survey made by the engineer of the Navy Department reviewed practices in 53 selected companies on use of executive and supervisory talent. One of the basic findings was that more than 50 percent of the top executives' time was spent on personnel administration and that every supervisor was a personnel manager within his sphere of influence. Solution to the problem of executive replacement was determined to be the creation of reserves of trained executives by the following means: organizational analysis to determine requirements of each executive position; selection of executives by multiple judgments and special tests; evaluation of performance, growth and potential of each individual executive by means of ratings; development of executives by correcting experience deficiencies; inventory control to catalog executive assets and make best use of executive and management reserves. The organization chart, *Fig.* 2, portrays schematically the principles and methods found practically applicable.

Executive Development Program

One well-conceived plan of executive development is that of Monsanto Chemical Co. The plan is presented in chart form, *Fig.* 3. Objectives are creation of a timed reserve of qualified and experienced personnel to fill vacancies and to develop executive and administrative personnel to meet in-

Fig. 2. Inventory control method showing replacement requirements of a typical industrial organization.

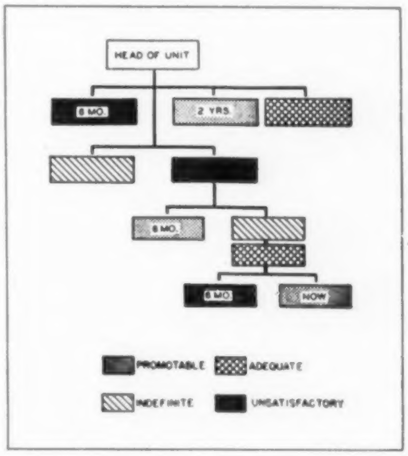
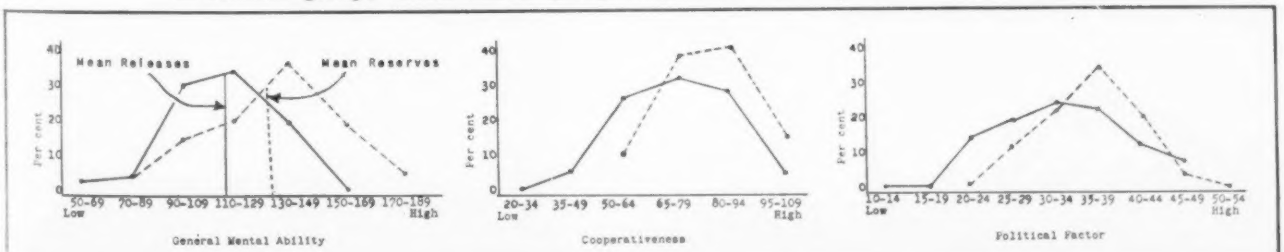


Fig. 1. Comparison of factors between successful and poor manager trainees. Solid line is released group; dotted line is group selected for future executives by program.



creased responsibilities of present positions. About 150 men are involved, selected from executive and administrative group and supervisory, professional and foreman personnel. Experience with this program can be summarized as follows: the program should be kept as simple as possible. It must be actively supported by top management. It should begin slowly and proceed step by step along well-considered lines. Executive development is a long-term process so results are not immediate. Age of participants should be as low as possible. Participants must be treated as individuals at all times and no promises should be made in advance. All records must be kept absolutely confidential and participants should not be identified in public. The results of this program have been a time reserve of qualified executive replacements.

Self-Development Progra

With these company programs as a background, what might be a good program of professional self-development for engineers? First, it must be done largely by the engineers themselves, and second, each company must provide inspiration, leadership and circumstances and wherewithal for each engineer or administrator to develop himself. If a company cannot do this, it could then ask a university to provide a course or refresher course for its engineers to fill the gap. Many universities have already developed advance-management courses for executives and managers from industry and business. These elements include planning, organization, coordination of departments, administrator appraisal and personnel specifications, simplification of methods, morale building, financial rewards, training of subordinates, counseling and interviewing, and performance records.

From a paper given before the ASME semi-annual meeting, 1954, Pittsburgh, Pa.

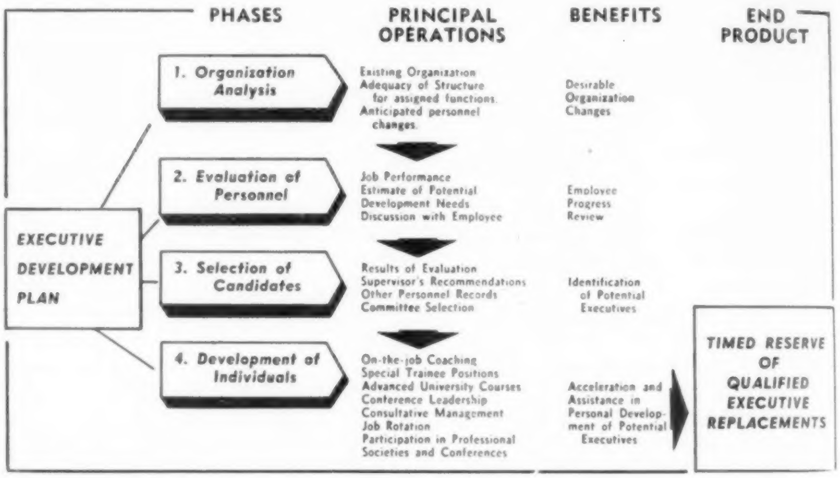


Fig. 3. Chart of executive development in Monsanto Chemical Co. Methods used will depend upon individual needs.

▼ ▼ ▼

Automation Design Trends

by Kurt O. Tech, Chief Engineer

The Cross Co., Detroit

Continued progress in automation in machine tool applications will depend to a large extent on the ability to control "down time"—the halting of machines because of unpredictable failures.

The modern concept sees automation as a method of manufacturing rather than a series of automatic material handling devices. Automation was not the product of a revolution, but of evolution. It was the result of development in mechanisms, hydraulics and electric controls.

It is in the continued development of such details of design that our hydraulic engineers are doing the most to further the art of automation. While there is no theoretical limit to the number of operations that can be combined in one machine or process, there is a practical limit—down time.

To eliminate down time hydraulic engineers are called upon not only to

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continuously develop simpler circuits but also to coordinate their efforts with those of the machine designers and electrical designers in order to arrive at a completely integrated design which will operate with a minimum of down time.

The importance of hydraulics is illustrated in one transfer machine in which there are approximately 109 separate hydraulic circuits. Hydraulic control is preferred over penumatic control in transfer machine elements because:

1. It is cheaper to operate
2. Better control and a more consistent time cycle is obtained
3. Air control of certain transfer motions under certain conditions is a definite safety hazard.

Many problems of design in automation fall within the province of the hydraulic engineers. The most important of these is stopping leaks on machine tools. One machine has approximately 7000 connections which can leak if not treated properly in design, manufacturing or maintenance. Other special design problems handled by the hydraulic engineer are found in the layout of piping and location of valve mountings, both of which must answer requirements of safety, accessibility and protection from damage.

From a paper given before the 1954 Nat'l. Conference on Industrial Hydraulics, Chicago.

▼ ▼ ▼

Cermets: New High Temperature Materials

by Robert Steinitz

American Electro-Metal Corp

Yonkers, N. Y.

New materials developed on the basis of combinations of metals with refractory compounds to some extent fill the the gap between so-called superalloys and ceramics. Cermets are produced by powder metallurgy and this special fabrication method results in unique properties. Some parts successfully made are shown in *Fig.* 1.

There is very little chance that the range of the so-called superalloys can be extended to higher temperatures by changing the composition somewhat or by adding a new alloying element. It will be necessary to go to entirely new materials to reach considerably higher temperatures.

Ceramics can stand high temperatures without dimensional changes and without variation in their properties. However, they are so brittle and especially so sensitive to heat shock that they would shatter if the ignition in an engine failed and cool air were sucked into the turbine.

Cermet materials are combinations of high melting substances and a metal which is supposed to supply the necessary ductility and heat conductivity to make the material insensitive to heat shock.

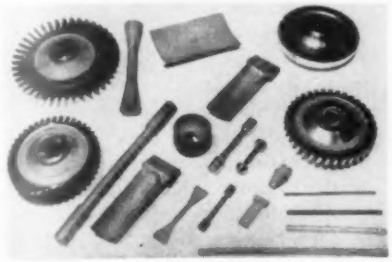

Fig. 1. Parts produced from TiC base cermet.

What materials are available for high temperature use especially for the refractory part of cermets? The chemical handbooks list as high melting materials oxides, carbides, nitrides, borides and silicides, *Fig.* 2.

The hard metal or metallic refractory, which is most common for cermet application at present, is titanium carbide. Titanium carbide has only fair oxidation resistance and two methods have been applied to improve the scaling resistance.

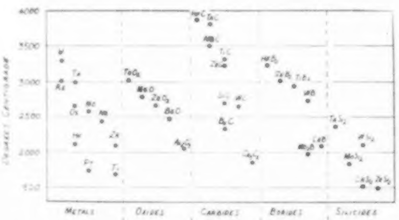

Fig. 2. Melting points of refractory materials.

The property which is still preventing the wide application of these new high temperature materials is unsatisfactory impact strength at room and at high temperatures. In some cases, the high temperature impact resistance is much better, but this is an exception.

New and stronger materials and materials with better impact strengths are being developed constantly. It is, however, not to be expected that materials would ever be created which are comparable to the superalloys in impact behavior, but have a higher temperature limit. With the constant request for higher and higher operating temperatures, the designer of engines must realize that he must change his standard way of thinking.

Use of brittle materials seems to be unavoidable if the service temperature is to be raised. For short-time applications such as rockets, some of the present day materials may be immediately applicable. Competition there is strong with standard ceramic substances. For rotating parts and machinery in which close dimensional tolerances are required at high temperatures, the present design and materials do not fit together yet. Even if cermet blading for an engine would fulfill all requirements for a rotating part, the shaft and the bearings would probably become considerably overheated due to the high heat conductivity of the cermet materials which, however, makes them insensitive to heat shock.

The metallurgist is trying to come closer to the requirements of the present day designer with the development of materials with better impact resistance.

From a paper presented before the 1954 meeting of the American Rocket Society.

technical digests

Cutting Waste Disposal Costs

by John W. Townsend

Consoer, Townsend & Associates
Consulting Engineers
Chicago, Ill.

The need for controlling the character of spent waters from industrial plants is evidenced by the polluted condition of many of our streams, lakes and rivers. It has been estimated that nearly one-half of the total pollutional load carried by the water courses in the United States is caused by the organic material discharged by industry. Reducing waste volume by improving housekeeping methods and separating contaminated waste from pollution-free waters within an industry, can result in a saving in the capital investment for treatment facilities and annual costs for treatment.

In the design of new industrial plants, serious consideration and study should be given to the location of the various processes discharging waste water, the method of conveying wastes of various types to a central point for treatment, and the location of treatment facilities with respect to the plant process installations. At existing industries faced with the problem of waste treatment, detailed studies should be made to determine the most practical and economical method of collecting wastes and transporting them to a plant for treatment.

In most instances, the method of treatment of industrial wastes is determined by requirements of the regulatory agency governing the water courses into which the effluent will discharge. No set standard method of treatment can be applied to all industrial wastes.

The most widely used method for the complete oxidation of cyanide wastes is by applying chlorine to an alkaline solution maintained at a pH of 8.5 or higher. The resultant chemical reaction will convert the cyanides to cyanates and oxidize the cyanates to carbon dioxide and nitrogen. A positive chlorine residual following the settling period will assure a complete reaction. Where flow volumes are large, the installation cost of continuous type treatment facilities will usually be less than batch type facilities. In the treatment of wastes containing metals from various plating operations, ferrous sulfate or sodium metabisulfite is used to reduce hexavalent chromium, and lime is used to precipitate such metals as copper, aluminum, zinc, cadmium, and trivalent chromium. Sulphur dioxide has also been successfully used to reduce hexavalent chromium. Rectangular separators of the API design are the most widely used for the removal of free oil from a waste.

Oil in an emulsified condition usually requires chemical treatment to effect separation. At a pH of 5.0 to 6.0, the emulsion will break and allow the oil to float to the surface of a clarifier where it can be skimmed.

Strong acids and alkali wastes are usually conveyed to a common basin for neutralization. Certain combinations of acids and alkalies will result in some self-neutralization. However, additional chemicals are usually required to provide an adequate balance.

The lagooning of sludge at large installations is an unsatisfactory method of disposal. However, the use of string-type vacuum filters for dewatering neutralized acids and hydroxide sludges blended with neutralized acids has proven successful.

From a paper presented at the 1954 annual meeting of the American Society of Lubrication Engineers.

▼ ▼ ▼

Production Application of Tungsten Arc Welding

By H. A. Huff, Jr.

Air Reduction Sales Co.

Inert gas-shielded tungsten arc welding is well established as a fabrication process. It is used principally for the hard-to-weld metals where quality is usually a prime consideration and where special problems attend the

achievement of quality. The tungsten arc process has been developed to meet high production requirements.

The commercial application of tungsten arc welding involves some problems which are not encountered in conventional methods such as stick electrodes. An understanding of these problems and knowledge of the means of meeting them are necessary to the full realization of the benefits the process offers. This paper discusses these problems and presents some bases for their solution. Included are considerations regarding power sources and electrodes, jigs and fixtures, the selection and proper use of shielding gases, and basic principles of automatic applications.

From a paper presented at the 2nd annual welding show and 1954 spring meeting of the American Welding Society.

▼ ▼ ▼

Spot Welding Thin Gage Aluminum Alloys

by I. W. Johnson
General Electric Co.

Considerable difficulty has been experienced in spot welding thin gage aluminum alloys. In many instances specialized equipment such as energy storage has been retained specifically for welding thin aluminum alloys. Through proper control of initial application, magnitude, and decay of welding current conventional single-phase spot welding equipment will produce satisfactory results. This paper presents and discusses data pertinent to the use of up-down slope control and electronic voltage regulator on single-phase spot welding equipment. These controls are available as standard auxiliary equipment.

The data reveals exceptional consistency of shear strengths. Based on calculations as stated in MIL-W-6860 where variation $= \frac{\text{Range}}{\text{Average}}$, variation less than 0.050 is obtained. Variation up to 0.35 is allowed by MIL-W-6860 specification. Data includes information on cleaning, electrodes, machine settings, methods of evaluation and test results. The results substantiate that single-phase spot welding equipment will satisfactorily weld thin aluminum alloys to MIL-W-6860 specification.

From a paper presented at the second annual welding show and 1954 meeting of the American Welding Society.

technical digests

Seam Welding Low Carbon Steel

by M. L. Begeman and G. Walker
University of Texas

This work covers the resistance seam welding of hot rolled low carbon steel sheets in three thicknesses, 0.031 in., 0.049 in., and 0.078 in. over a wide range of speeds. Particular emphasis is given to presenting data and schedules for welding speeds higher than those for which data have been available. Controllable factors are presented and discussed with respect to the effect of deviations from optimum values. The criteria established for satisfactory seam welds are: (1) minimum porosity; (2) sufficient nugget overlap to insure consistently pressure tight welds; and (3) reasonable allowable deviations in the welding variables to insure uniform results.

Complete schedules are presented for each thickness to aid users of seam welding equipment in rapidly selecting suitable welding conditions for their work. Also presented is a brief but complete coverage of the facilities, equipment, and instrumentation used in conjunction with the seam welding program at the University of Texas.

From a paper given before the 1954 American Welding Society fall meeting, Chicago.

▼ ▼ ▼

Adhesive Bonding Compared with Soldering and Brazing

by Henry H. Simons
Eutectic Welding Alloys Corp.

First the principles of adhesive bonding of metals are discussed. This is followed by comparisons of the mechanical and physical properties of adhesives, brazing alloys and solders. Designing for adhesive bonding, brazing and soldering as reviewed subsequently and the properties of various types of joints are analyzed.

The major methods of room and elevated temperature bonding are discussed for single and mass-production setups. Careful attention is given to the advantages and limitations of each procedure and process. Filling and sealing with brazing alloys, solders and adhesives are also discussed.

From a paper presented at the second annual welding show and 1954 meeting of the American Welding Society.


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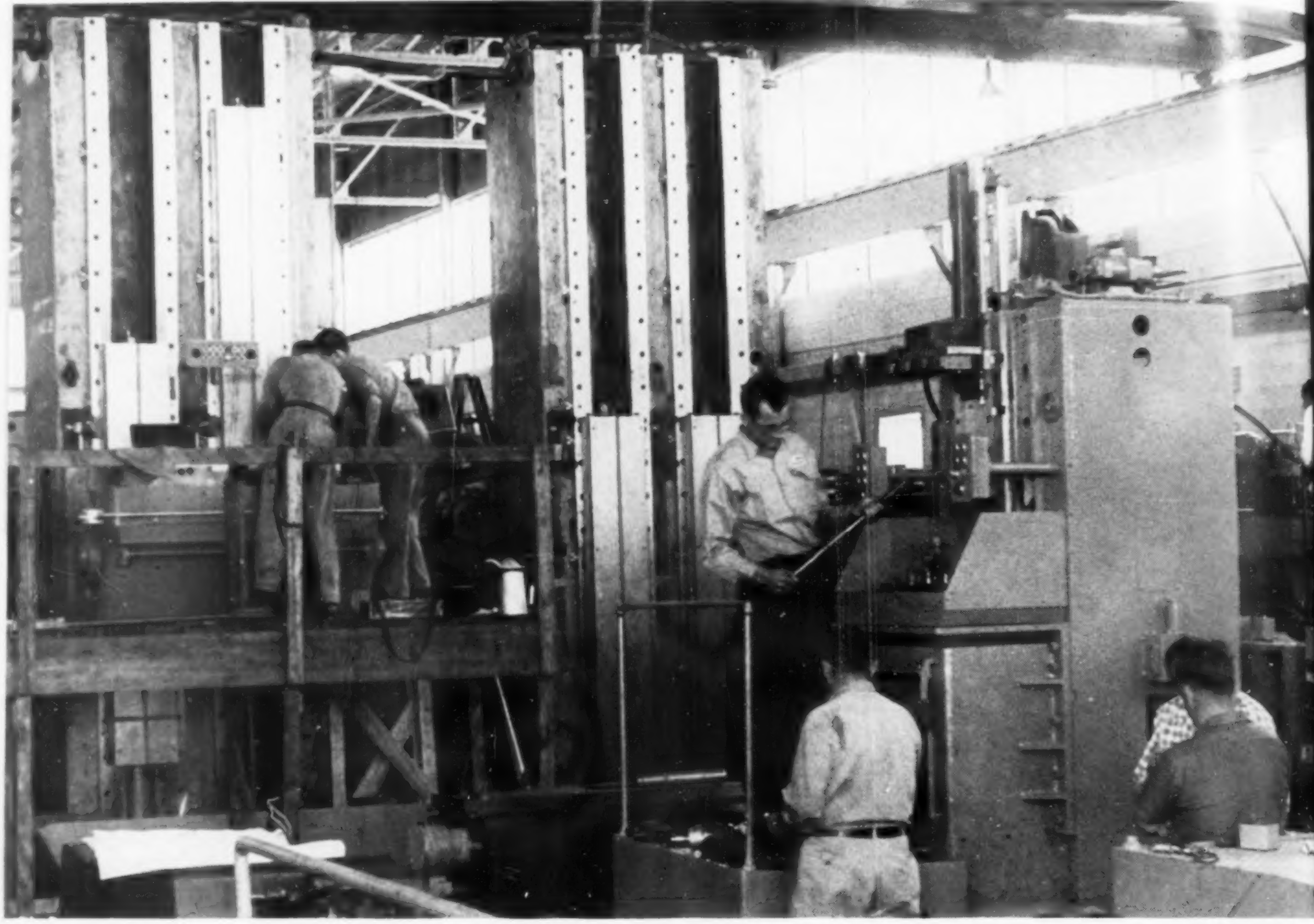

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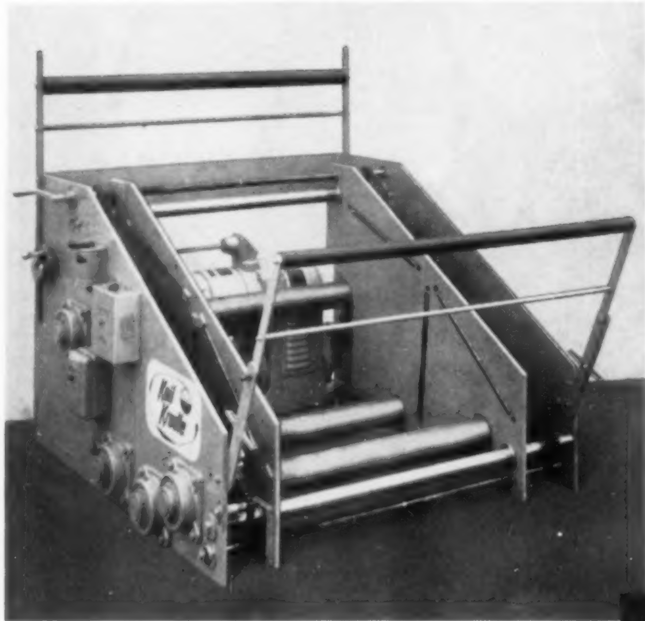

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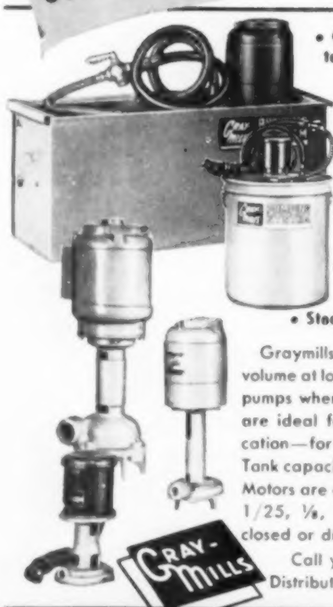

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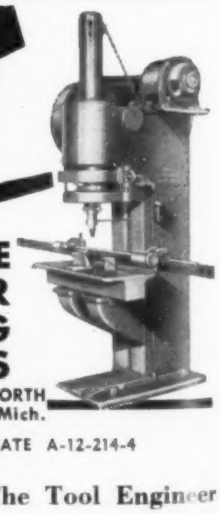

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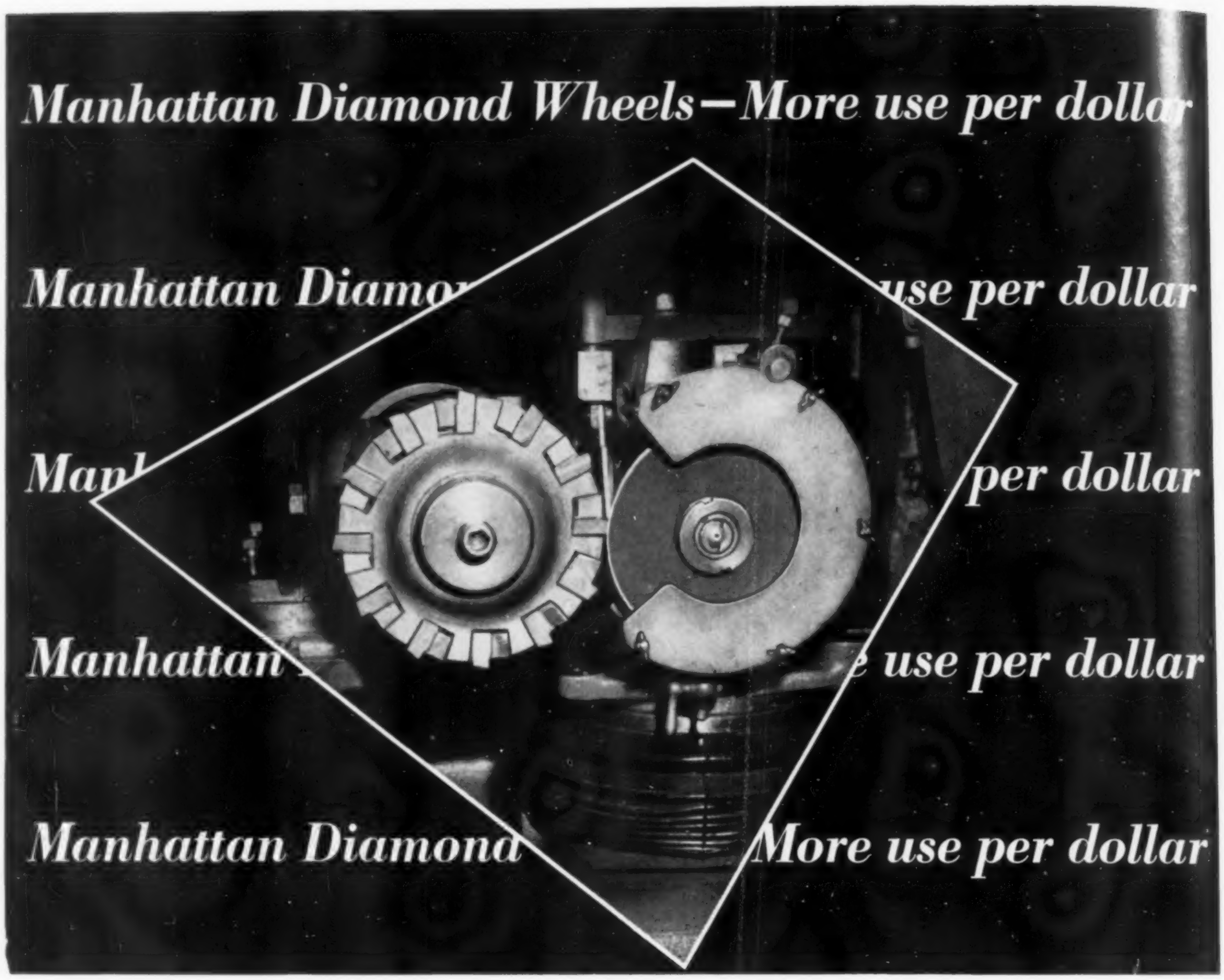

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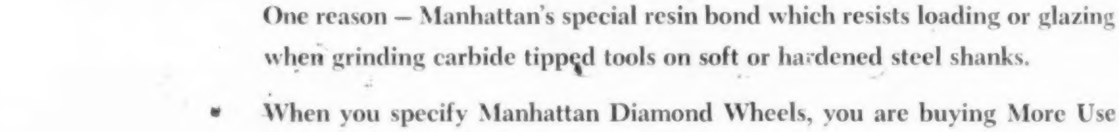

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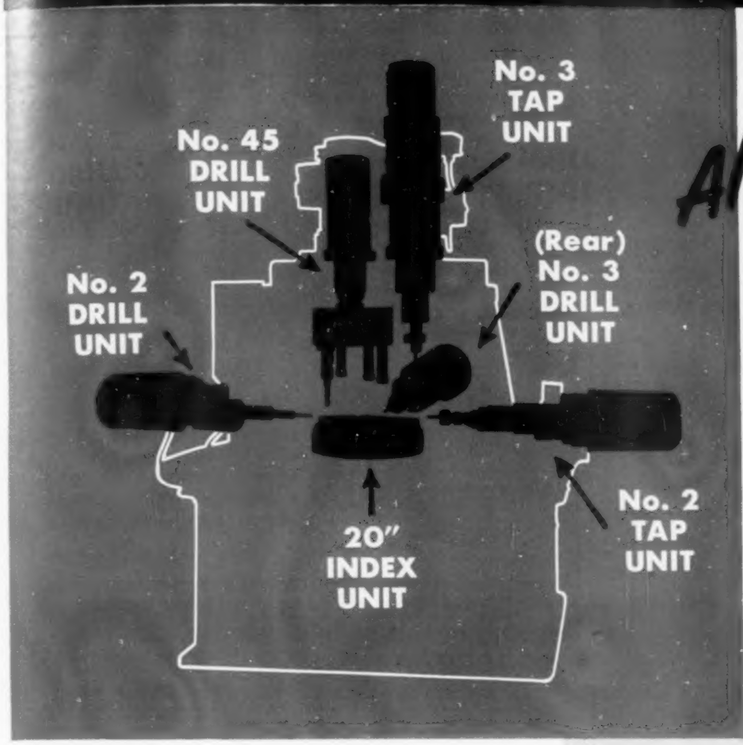
Asbestos Textiles • Teflon Products • Packings • Sintered Metal Parts • Bowling Balls

 FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-218

Rehnberg-Jacobson



STANDARDIZED

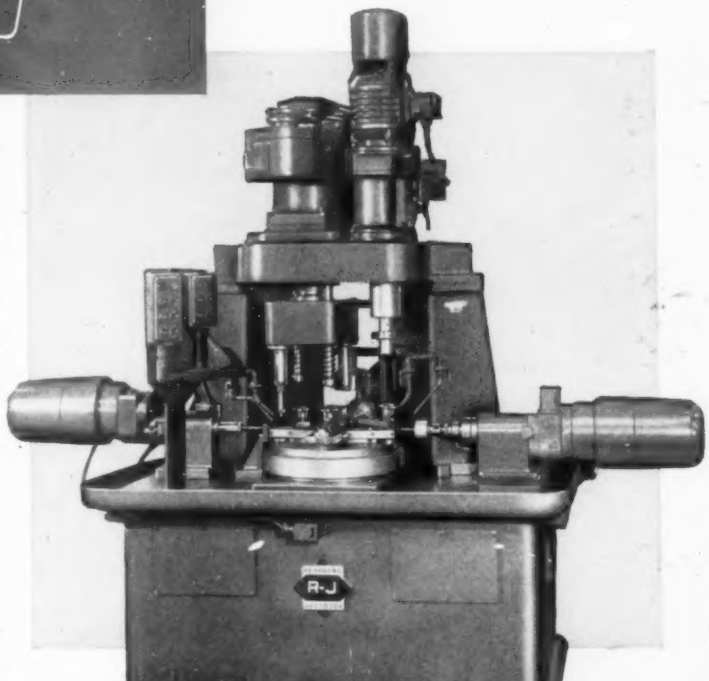
All-Mechanical Units

PRODUCE VERSATILE MACHINE AT LOW COST

The diagram at the left shows clearly the standardized R-J Units which have been combined to produce the machine shown below. These are ALL-MECHANICAL units — easy to operate, easy to adjust, and easy to understand. R-J Standardized Units are also available separately, for installation as you choose.

CAN YOU COMBINE OPERATIONS?

Have you checked your shop recently, to see if you might combine some operations on a production piece? This machine is a good example: it drills, taps, faces, counterbores, and performs a circular serration operation on a simple little forging. The fixtures have interchangeable adapters for four different sizes of the piece. The feature of the Rehnberg-Jacobson method is simplicity, using standardized units on an uncomplicated structure and employing considerable ingenuity in the arrangement of the machine and design of the fixtures. If you do look around and find where you might use such a machine, let us know so one of our men can drop by to talk it over with you . . .



REHNBERG-JACOBSON MFG. COMPANY

DESIGNERS & BUILDERS OF SPECIAL MACHINERY

R-J

2135 KISHWAUKEE ST.
ROCKFORD, ILLINOIS

Tough grinding jobs?

Check Vulcanaire high speed precision grinding heads!

Grinding circular slot using Vulcan's Rotary Table and Magnetic chuck.

Many seemingly impossible grinding problems have been solved by adapting Vulcanaire to standard machines or by using one of Vulcan's specially designed machines.

On Surface Grinders, merely remove wheel and guard, clamp vertical or horizontal adaptor to machine as illustrated. No belts necessary. For instance, Vulcanaire used in connection with Vulcan's Rotary Table for Surface Grinders permits the grinding of a circular slot.

Vertical adaptor for Surface Grinders. Grinding small slots

Adaptors are in stock to fit the spindle of Vertical Milling Machines for grinding contours, holes and slots.

On Internal Grinding Machines Vulcanaire's infinitely controlled speeds furnish the correct surface cutting speed resulting in faster production and micro finish. The adaptor sleeve fits into present housing.

Applied to Jig Boring Machines, Vulcanaire is liked by leading precision manufacturers because its accuracy is guaranteed, producing Vulcanaire jig grinding of large and small parts.

Horizontal application. Grinding a shoulder Punch.

Send us a blue print on your toughest grinding problem. Recommendations and sketches will be returned to you — no obligation.

Major Vulcan Services

Engineering, Processing, Designing and Building . . Special Tools . . Dies . . Special Machines . . including the Vulcan Hydraulics that Form, Pierce, Assemble and Size . . Vulcanaire Jig Grinders . . Plastic Tooling . . Vulcan Rotary Tables.

VULCAN TOOL CO.
7300 Lorain Avenue • Dayton 10, Ohio

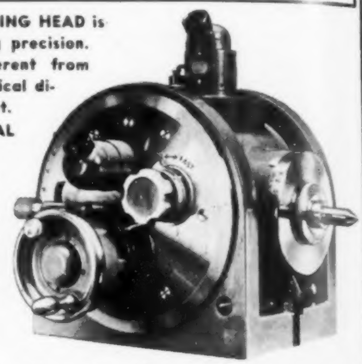
USE READER SERVICE CARD; INDICATE A-12-220-1

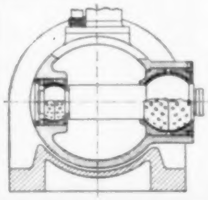
The New LEITZ Optical Dividing Head

A CUSTOMER SPEAKS:

"Without our Optical Dividing Head, we would not even attempt to make the critical indexing work nowadays necessary for things that fly, or mechanism that must control angular motions to hit targets at a distance to measure degrees, minutes and seconds, to eliminate angular velocity errors and vibrations in quick running mechanisms, etc."

The LEITZ OPTICAL DIVIDING HEAD is the last word in indexing precision. Its construction is different from other optical and mechanical dividing heads on the market. A NEW DOUBLE SPHERICAL BALL BEARING, DOUBLE READING IN THE SAME EYEPIECE 180° APART, motor drive attachment and other features make the LEITZ an important aid required in any shop where precision is demanded.





The 2 spherical ends of the spindle are carried in hardened steel cups with several hundred small precision balls held in place by ball cages in such a way that each ball creates its own path. There is no play, either radially or axially, no oil film, no wear and a very large load capacity.

Write for Descriptive Bulletin --- Code GIPAD

Geo. SCHERR OPTICAL TOOLS, Inc.
200-TE LAFAYETTE STREET • NEW YORK 12, N.Y.

USE READER SERVICE CARD; INDICATE A-12-220-2

MAYLINE

MAYLINE Metal Plan Files are efficient

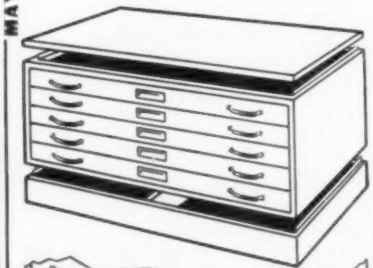
With hinged dust cover filing proceeds rapidly and efficiently.

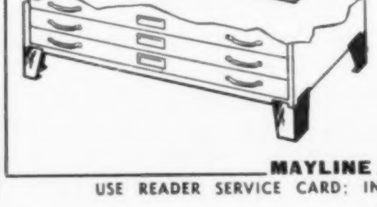
Same size file units interlock securely.

See your local dealer.

MAYLINE

MAYLINE





Symbol of Superiority

MAYLINE CO.

formerly

ENGINEERING MFG. CO.

611 No. Commerce St.

Sheboygan, Wisconsin

MAYLINE

USE READER SERVICE CARD; INDICATE A-12-220-3

SCULLY JONES

Does five operations at with the help of Scully-

Michigan Hydro 20 "factory-equipped" with Scully-Jones Adjustable Adapters and Drill Chucks

Michigan makes sure this multiple-spindle machine operates with high precision at maximum efficiency by equipping the spindles with "Precision Holding" Tools—Scully-Jones Quick-Lock Adjustable Adapters to speed setup and tool changes, guard against spindle distortion, and provide quick depth adjustments—Scully-Jones Drill Chucks to increase accuracy and reduce tool breakage.

the rate of 100 per hour
Jones "*Precision Holding*" tools

Improved four-slot design, now standard on all Scully-Jones Drill Chucks 1/8" and larger, has better seating and collet action and greater resistance to pull-out. This means less tool breakage and downtime, plus added assurance your drills will run true.

Quick-Lock Adjustable Adapters, with new "Keyhole" slot, eliminate damage often caused by hammering with conventional drift, make tool changes faster and easier.

More trouble-free production is now possible on multiple-spindle machines equipped with *improved* Scully-Jones Quick-Lock Adjustable Adapters. The new "Keyhole" slot and Ejector make tool changes faster, easier, and safer. The pilot nose minimizes any tendency of adapters to bind or jam in the spindle. Your machines are protected against misalignment and damage by these easy-operating, more accurately fitting tools. And, with quick and easy adjustments of the Quick-Lock Nut, you speed setup and accurately control cutting tool depth.

More good news! Scully-Jones Drill Chucks . . . offering increased resistance to "pull-out," improved seating, and truer collet action . . . are now available from stock. The new four-slot design gives you all the advantages of small diameter, plus added protection against tool breakage and production shutdowns.

Your factory-trained Scully-Jones representative or distributor can demonstrate these advantages to you, and explain why Scully-Jones tools hold accuracy and last longer, even under hard usage.

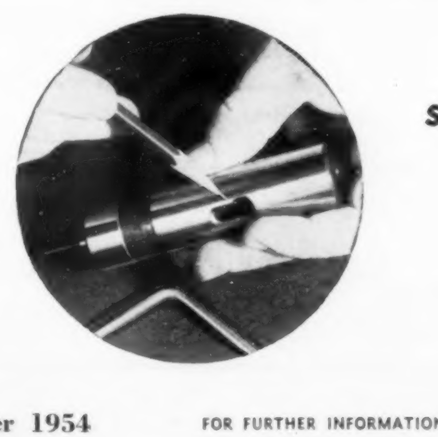
Next time you buy *or build* a machine tool, make sure it's equipped with Scully-Jones "Precision Holding" tools.

SCULLY JONES

SCULLY-JONES

"Precision Holding" for holding precision

Scully-Jones and Company, 1906 S. Rockwell Street, Chicago 8, Illinois



NEW "KEYHOLE" TOOL EJECTOR

SAFEGUARDS MACHINE ACCURACY!

. . . another reason you should ask for Scully-Jones Adjustable Adapters, Sleeves and Sockets, Quick-Change Chuck Collets, Turret Tool Holders, and Counterbore Drivers, on which "Keyhole" slots are the *new standard*. Write for details in Bulletin 14-50.

 FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-225

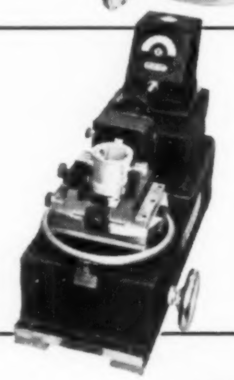
NUMBER ONE IN A SERIES

What's The Best Way To Gage These Parts ?

Tips from Taft-Peirce on when and where to use a T-P CompAIRator Air Gage

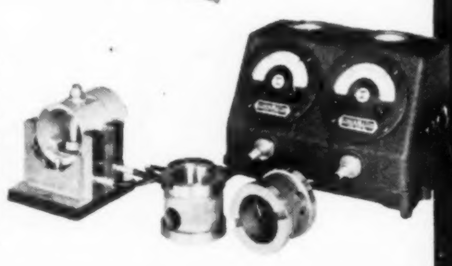
Three OD's
Tolerance: .0009″

One three dial T-P CompAIRator and Air Snap Gage checks three points simultaneously on the journals of an automotive crankshaft. Functions of the diameter (taper, barrel shape, etc.) may be seen at a glance. Simple, accurate, fast — savings in inspection time alone paid for this unit in short order.



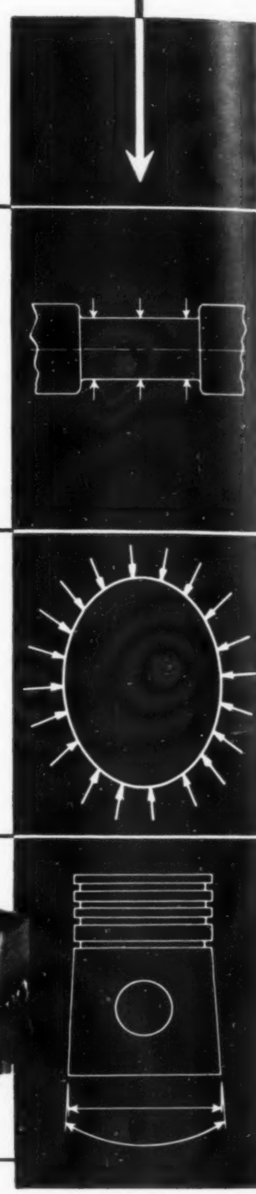
Ovality
Tolerance: .007″ on radius

One single dial CompAIRator Air Gage checks the contour of the skirt section on this piston. Indexing table is graduated in 5° increments, permits checking entire contour at one setup. Extremely sensitive yet sturdy, vibration, jarring, tilting won't disturb the accuracy of a T-P CompAIRator.



Taper and Diameter
Tolerance: .002″

A two dial T-P CompAIRator slashes former inspection costs. One indicator checks diameter. The other, a new T-P Computing CompAIRator, measures and *figures* the taper. Indicates it directly on the dial face. Eliminates usual 2 measurements and a computation. Computing CompAIRators may also be used to check center distance, concentricity of diameters, and squareness of bore to face.

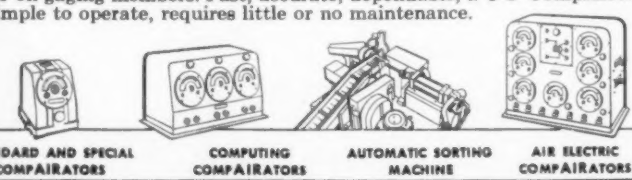


For more examples and the complete story on Taft-Peirce CompAIRator Air Gages send for Bulletin.

T-P means Top Precision

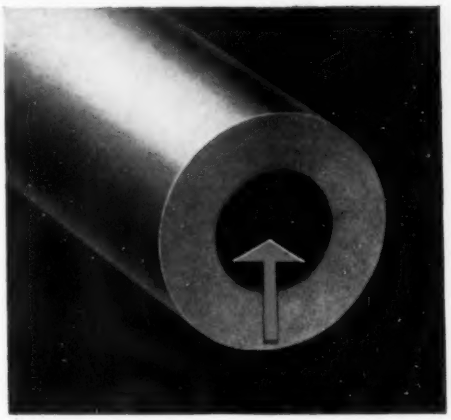
WHAT IS A COMPAIRATOR AIR GAGE?

A CompAIRator is a sensitive gaging instrument that measures variations in the velocity of tiny jets of air. When work is placed over these jets, air flow is restricted and its velocity reduced. Any change in air velocity reflects a change in part size, which is immediately shown on a calibrated indicator. Since only air contacts the part in most cases, there is minimum wear on gaging members. Fast, accurate, dependable, a T-P CompAIRator is simple to operate, requires little or no maintenance.



THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND

a hole here is annoying . . .



a hole here is helpful

Crucible Hollow Tool Steel Bars are helping eliminate the wasteful practice of drilling out a solid bar to make ring-shaped, or tubular steel parts, or tools with a center hole. The hole is already in Crucible hollow tool steel bars . . . no need for drilling, boring, cutting-off or rough-facing operations.

You can get these hollow bars in any of Crucible's famous tool steel grades, in almost any combination of O.D. and I.D. sizes. And you can get *immediate* delivery of five popular grades—KETOS® oil-hardening, SANDERSON® water-hardening, AIRDI 150® high carbon-high chromium, AIRKOOL® air-hardening, and NU DIE V® work tool steels—from a conveniently located Crucible branch warehouse.

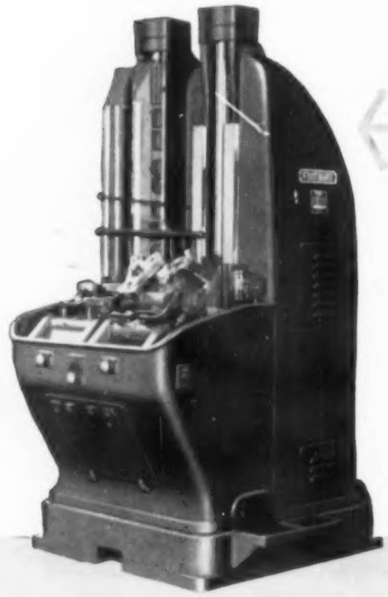
Call your Crucible representative for the full story of how these steels can best save you time and money. You'll be glad you did.

CRUCIBLE first name in special purpose steels

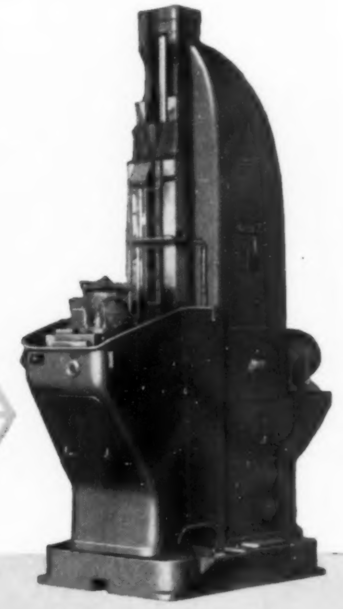
54 *years of Fine steelmaking*

HOLLOW TOOL STEEL

CRUCIBLE STEEL COMPANY OF AMERICA • TOOL STEEL SALES • SYRACUSE, N. Y



Duplex Surface Broaching Machine. Made in 5, 10, 15 and 25 Ton Sizes.



Single Slide Surface Broaching Machine. Made in 5, 10, 15 and 25 Ton Sizes.

A FASTER *more economical* MACHINING OPERATION

● Footburt Surface Broaching may be the answer to your problem of faster machining. Many jobs that were slow and expensive when handled by conventional machining methods are now being produced by Surface Broaching. Production in most cases is as fast as the speed at which parts can be loaded. Yet cutting speeds are so low that the cost of tool maintenance shows great savings. Exceptional finish can be maintained. We will gladly discuss your machining problems with you.

THE FOOTE-BURT COMPANY
Cleveland 8, Ohio
Detroit Office: General Motors Building

Continuous Type Broaching Machine. Made in 5 Sizes.

FOOTBURT

SURFACE BROACHING

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-230

"... cost of the projector will be returned within a three-month period"

CUTLER-HAMMER
MOTOR CONTROL
CH

Tool and Die Dept.

SUBJECT: Report of Savings through use of KODAK CONTOUR PROJECTOR in Tool Inspection

1-This report covers the period from June 1 through 30.

2-During this period, a Kodak Contour Projector was used to check circular form tools; flat drills, taps, and special cutters received from suppliers; and board samples.

3-The following table summarizes direct labor savings in man hours effected by replacing manual inspection with inspection on the Contour Projector. Time required for manual inspection is estimated on the basis of past experience with these parts.

Parts Checked	Direct Labor, Manual Insp.	Direct Labor, Optical Insp.	Savings (In man hrs.)
Circular form tools	350 hours	50 hours	300 hours
Flat drills, taps, special cutters	375 hours	65 hours	310 hours
Board samples	250 hours	90 hours	160 hours
		Total man hours saved	770

4-Without savings cited here, three additional men would have been required for these inspections. In addition, use of the Contour Projector has reduced the possibility of error and resulted in more consistent checking.

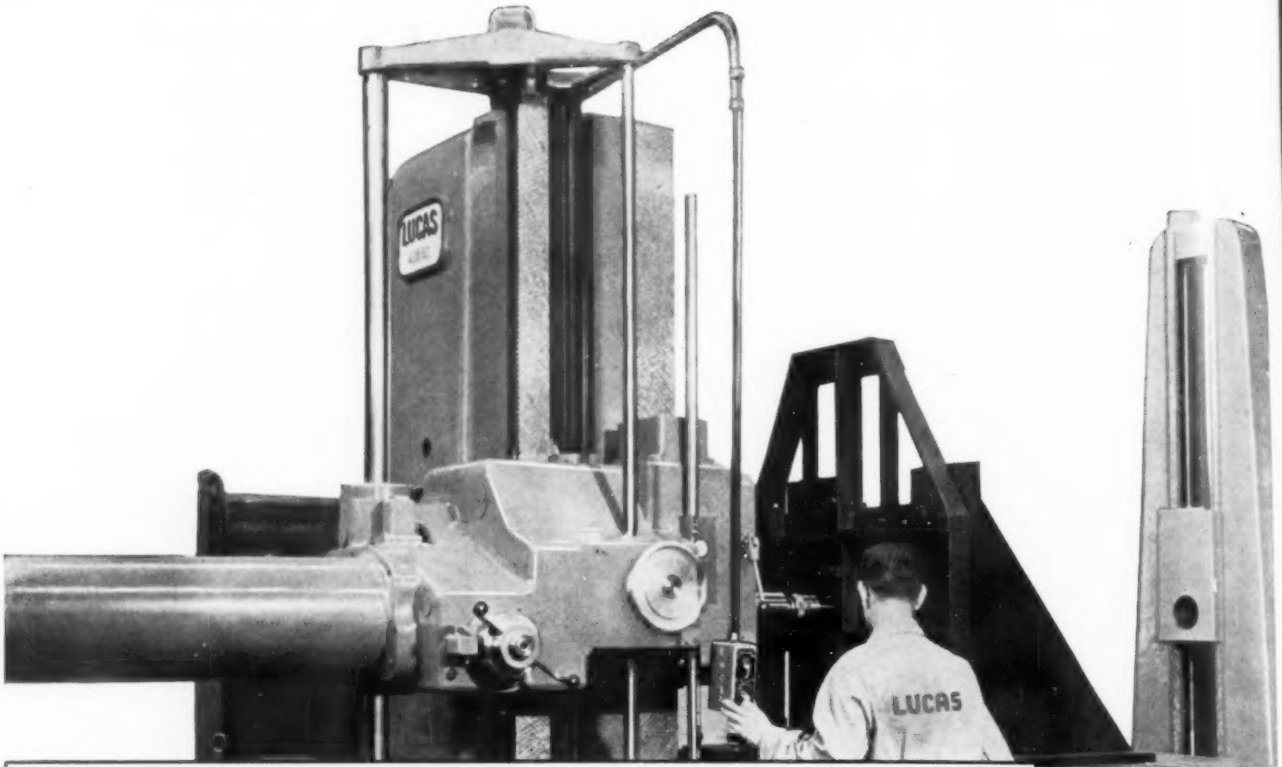
5-RECOMMENDATION: Based on the knowledge that these savings can be duplicated each month with present tool room volume, purchase of a second Kodak Contour Projector is recommended. This opinion recognizes the fact we are now checking with one machine only about 40% of all work suitable for the projector. Assuming man hour savings equal to those already effected, cost of the projector will be returned in direct labor savings within a three-month period.

Such reports by users of the Kodak Contour Projector are typical. To find out more about how optical gaging speeds inspection, improves accuracy, write for a copy of the illustrated booklet "The Kodak Contour Projector."

EASTMAN KODAK COMPANY, Special Products Sales Division, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak
TRADE-MARK



Here is the new, lightweight, swing-about pendant control on the Lucas horizontal boring machine. This flexible control places at the operator's finger tips, over the entire working area about the machine, START, STOP, JOG (forward and reverse) of the spindle rotation, and START, STOP, INCH and RAPID TRAVERSE of all unit motions.

Two smooth operating switch levers in this small-dimension pendant do the work of ten control buttons. The position of the levers gives quick visual indication of engagement and direction. One of many features that is keeping Lucas out in front among horizontal boring, drilling and milling machines.

LUCAS MACHINE DIVISION

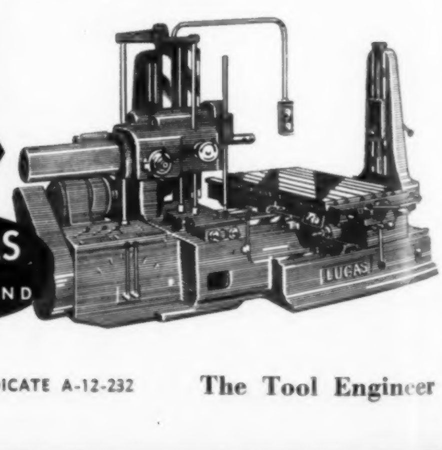
THE NEW BRITAIN MACHINE COMPANY • CLEVELAND 8, OHIO

. . . Machines for Making Progress

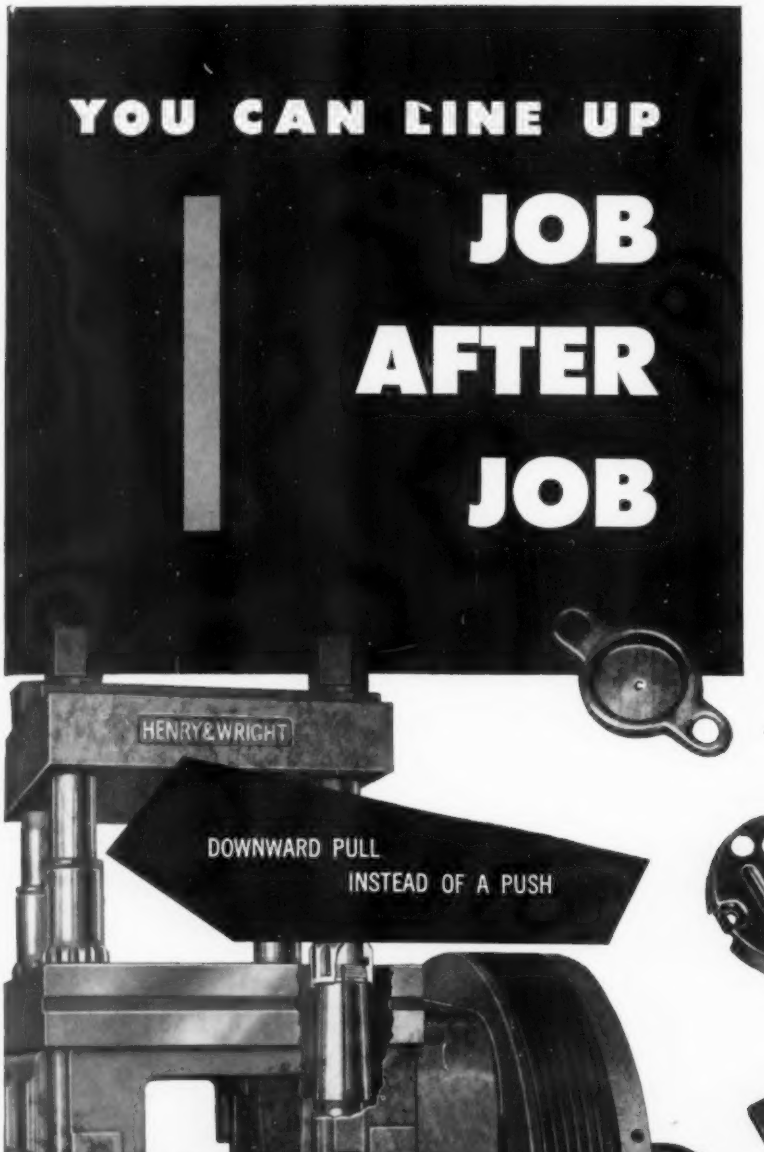
Lucas Horizontal Boring, Drilling and Milling Machines

Our general catalog is filed in the Sweet's Machine Tool Catalog File.

LUCAS OF CLEVELAND




Special
INTRODUCTORY
OFFER!
ACE
FOR
L. S. 1—L. S. 2



The Henry & Wright Dieing Machine is easy enough to set up so that moderate production runs are profitable.

You can schedule one job after another. Your H & W will get the work out, get it out right, and have it done when the schedule says it ought to be done.

Simple jobs that you want to complete at high speed. Close tolerance work. Tricky reverse bends. Full assemblies at one pass through the press. They all will go through your Henry & Wright, and with surprisingly short interruptions for setting up.

Four corner control of side thrust, and a downward pull instead of a push: These are two of the reasons why your Henry & Wright will withstand more off-centering of the die loads. Jobs like those shown can be easily run in sequence on an H & W.

Henry & Wrights are making production runs that designers never had dreamed could be stamped at a profit. Our representative would like to show you some of the pieces.

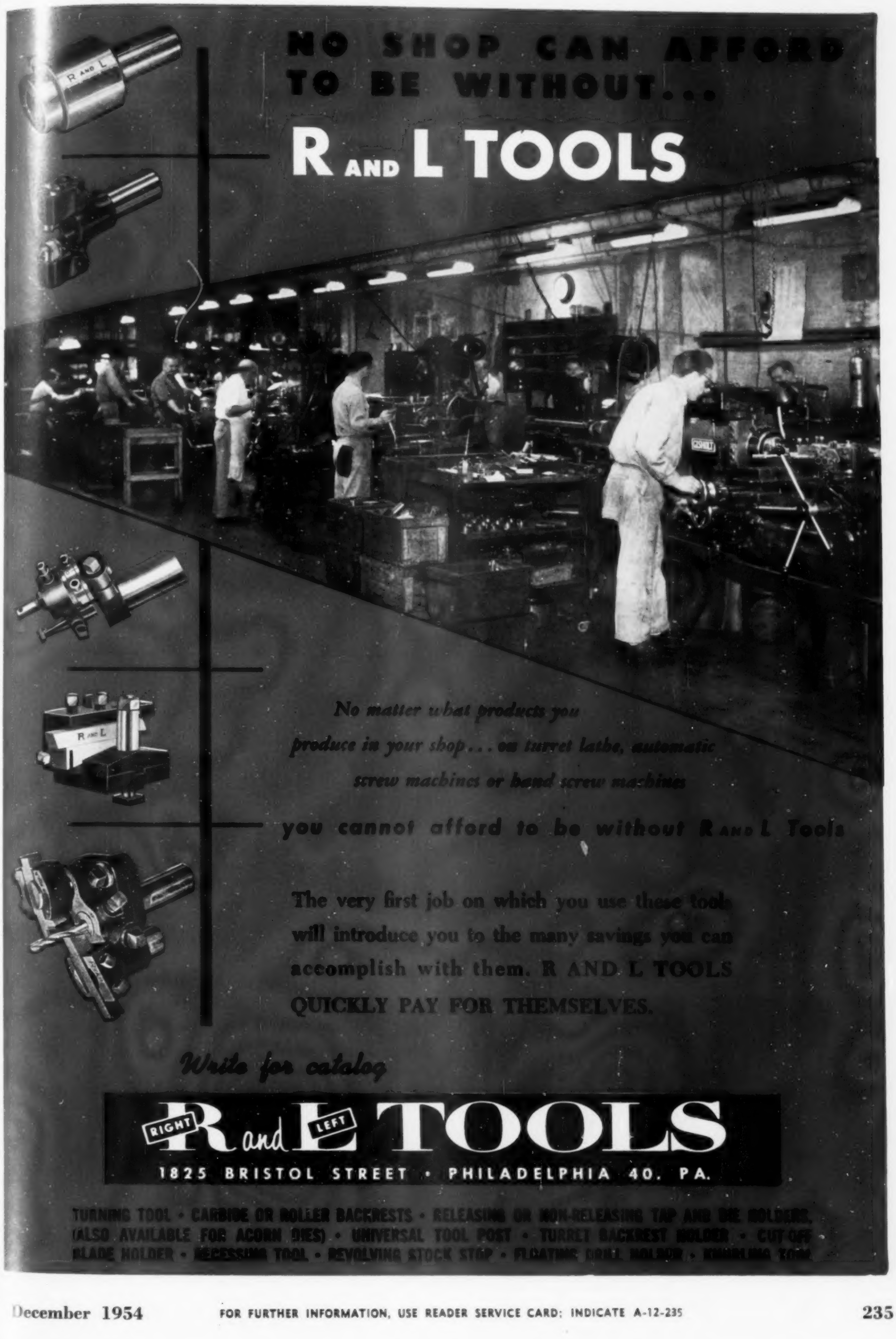
Please write to Henry & Wright, 421 Windsor Street, Hartford, Connecticut.

H&W®

HENRY & WRIGHT

DIVISION OF EMHART MFG. CO.

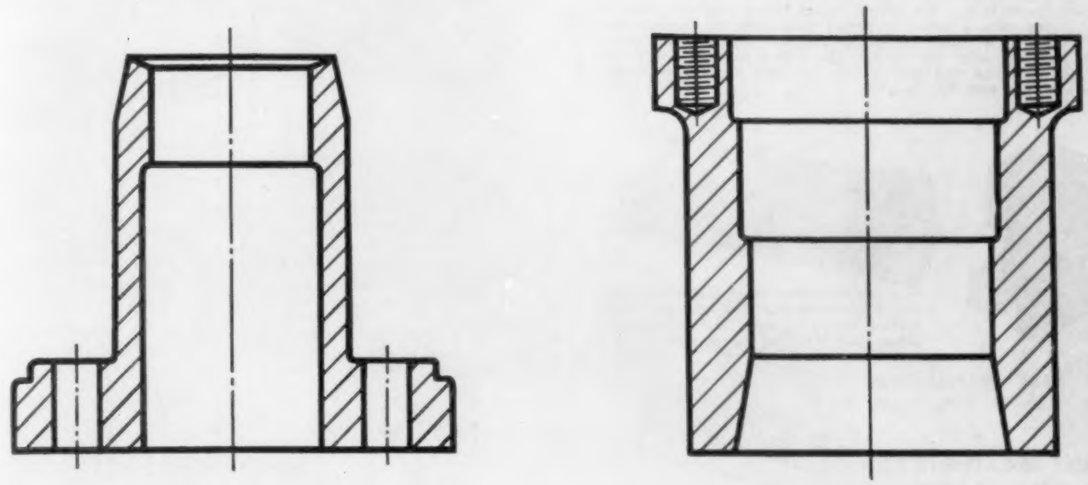
HARTFORD, CONNECTICUT

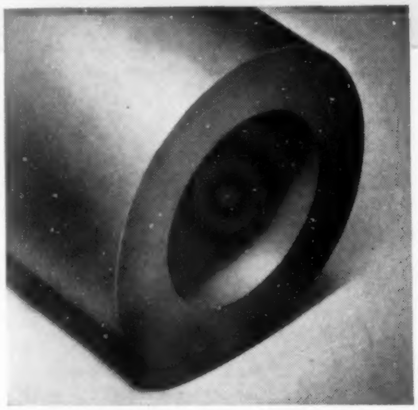

NO SHOP CAN AFFORD
TO BE WITHOUT...
R AND L TOOLS
No matter what products you
produce in your shop... on turret lathe, automatic
screw machines or hand screw machines
you cannot afford to be without R AND L Tools
The very first job on which you use these tools
will introduce you to the many savings you can
accomplish with them. R AND L TOOLS
QUICKLY PAY FOR THEMSELVES.
Write for catalog
RIGHT R and L LEFT TOOLS
1825 BRISTOL STREET • PHILADELPHIA 40, PA.
TURNING TOOL • CARBIDE OR ROLLER BACKRESTS • RELEASING OR NON-RELEASING TAP AND DIE HOLDERS,
(ALSO AVAILABLE FOR ACORN DIES) • UNIVERSAL TOOL POST • TURRET BACKREST HOLDER • CUT-OFF
BLADE HOLDER • RECESSING TOOL • REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL

HOW TO MAKE RING-SHAPED TOOL STEEL PARTS FASTER AND EASIER

FORMING AND PIERCING DIE

BLANKING AND FORMING DIE





Graph-Mo Hollow-Bar comes in sizes from 4 to 16 inches O. D. with various wall thicknesses. Immediate delivery on many sizes from warehouses of the distributors, A. Milne Co. and Peninsular Steel Company.

New GRAPH-MO HOLLOW-BAR® eliminates drilling— and machines 30% faster

YOU can eliminate the time-consuming drilling operation when you make ring-shaped tool steel parts from Graph-Mo Hollow-Bar®. The hole comes ready-made. First step is finish boring. There's less scrap, and you use less steel.

On top of that, the rest of the machining's faster—30% faster, compared to other tool steels. That's because Graph-Mo has free graphite in its structure. It means less tendency to pick up, scuff and gall, too.

That same graphite plus diamond-hard carbides give Graph-Mo amazing wear resistance. Users have written us that Graph-Mo outwears other tool steels, on the average, three to one!

Graph-Mo responds uniformly to heat treatment. And no other tool steel is as stable. Proof: after 12 years, a typical Graph-Mo steel master plug gage changed less than 10 millionths of an inch in dimension!

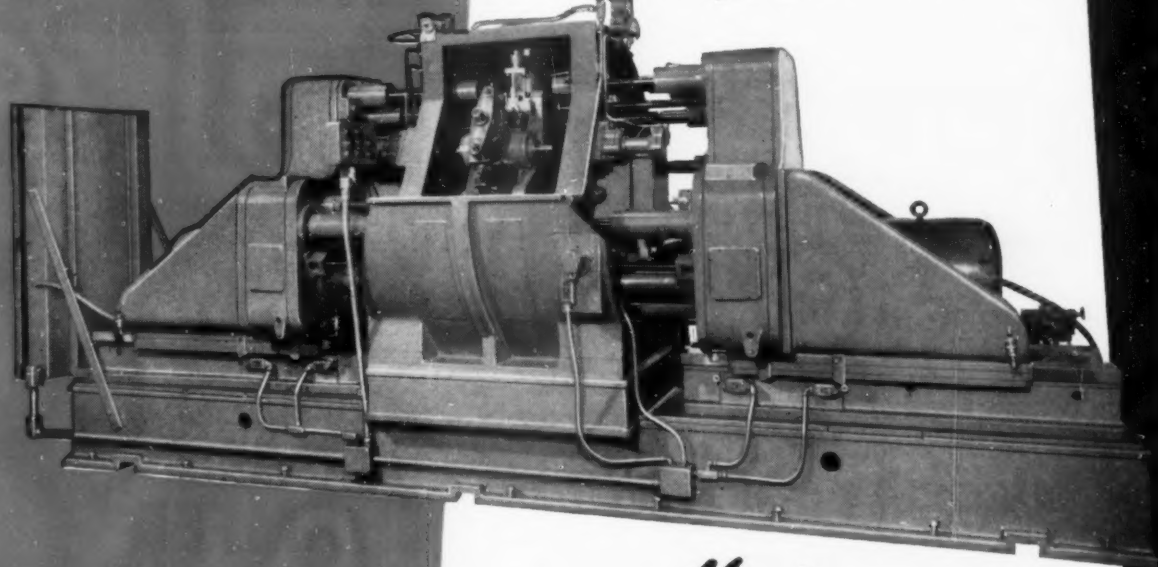
More facts about Graph-Mo Hollow-Bar? Write The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

 FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-12-239

...in just 23 seconds!



with this *Morris* mor-speed production machine

OPERATIONAL CYCLE:

STATION	
1	Double Load and Unload
2	Drill four 1" holes
3	Re-drill holes to $1\frac{7}{16}$"
4	Rough face four holes
5	Finish face four holes
6	Chamfer four holes

The Morris Two Way Horizontal High Production Machine finishes universal joint flange yokes at the rate of 156 per hour at 100% efficiency.

It, like other Morris MOR-SPEED Machines, is made up of standard MOR-SPEED units plus certain special parts. Because of Morris methods and standard designs, the user gets a special purpose machine . . . capable of high speed, precision production . . . without the usual sky-high cost and limited application of a "special machine."

Morris MOR-SPEED Machines save space, time and costs for leading manufacturers in every industry.

If you have multiple drilling, tapping, boring or similar operations on a mass production basis, Morris Engineers may may be able to show you substantial savings on a modest investment.

Ask your Morris representative for details on our deferred payment plan.

Follow a MOR-SPEED Line

Morris

THE MORRIS MACHINE TOOL CO.
950 HARRIET STREET
CINCINNATI 3, OHIO

TOOLING for WESTERN INDUSTRIAL EXPANSION!

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TO SAVE YOUR TIME ON ARRIVAL AT THE EXPOSITION, FILL IN AND MAIL THIS COUPON TODAY.

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10700 Puritan Ave., Detroit 38, Michigan

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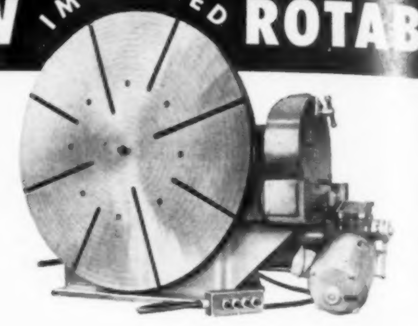
NEW IMPROVED ROTAB



Inspection operations are simplified, providing closer quality control on radial and angular checking.

One feature is the addition of an optical micrometer microscope with glass vernier recticle which permits direct reading to 5 seconds of an arc.

Checking and measuring planes are conveniently positioned for easy reading.

New controls have been incorporated to simplify and speed the operation of ROTAB in all its movements.

Made in four sizes with 12", 24", 36" and 48" face plates.

Let us give you the complete story

MACHINE PRODUCTS CORPORATION
6771 E. McNichols Rd. Dept. G Detroit 12, Mich.

USE READER SERVICE CARD; INDICATE A-12-242-1

Acme's New *Direct-Reading* CHAMFER *Micrometer* GAGE

Accurately, Directly, Reads End Diameters Of Chamfers Up To 1".

TWO MODELS

From 0° Chamfer To 90° and 90° Chamfer To 127° included angle maximum Chamfer

• Chamfer Depths Easily Computed

Simple To Use

● Reads like any standard depth micrometer. Precision made for close tolerance work. Saves time, reduces error, reduces rejects. Quickly pays for itself. Send for details.

ACME INDUSTRIAL COMPANY
208 N. LAFLIN ST., CHICAGO 7, ILL.

MFRS. OF STANDARDIZED DRILL JIG AND FIXTURE BUSHINGS

USE READER SERVICE CARD; INDICATE A-12-242-2

22nd ASTE ANNUAL MEETING

TECHNICAL PAPERS AVAILABLE NOW

Mail Your Order Today

The following technical papers delivered at the 22nd Annual Meeting of the American Society of Tool Engineers, in Philadelphia, April, 1954, are ready for immediate distribution

Paper No.	*Title*
T1	Rolled Extrusion of Thin-Walled Parts
T2	Rubber-Clamping Assembly of Thin-Walled Parts
T3	Surface Finish Control with Blast Cleaning
T4	Ultrasonic Techniques in Industrial Cleaning
T5	A Program for Developing Tool Engineers into Manufacturing Executives
T6	Scanlon Employee Relations Plan at Different Production Levels
T7	Recent Developments in Analysis of Chip Formation
T8	Turning Research Can Double Your Production Per Labor Hour
T9	Magnetic Holding of Ferrous and Nonferrous Materials
T10	Jig Design for Multiple Automatic Operations
T11	Process Applications for Dual-Frequency Induction Heating
T12	High-Production Tooling for Induction Heating
T13	How to Plan a Transfer Machine
T14	Creativity in Mechanical Design
T15	Changing Trends in Mechanical Fasteners
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T20	Tracer-Controlled Pantographic Milling
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T43	Tooling for Powdered Metal Parts
T44	Plastic Fixtures Have Wide Use
T45	Plastic Dies Move Into Regular Production Service
T46	Plastic Auto Body Developments
T47	Welding and Brazing of High-Temperature Materials
T48	Ferrous and Nonferrous Stud Welding
T49	Principles of Stretch Wrap Forming
T50	Planned Pre-Deforming of Shapes for Better Drawing

PANEL DISCUSSIONS

(Available after August 15, 1954)

P1	Production Planning and Control
P2	Tooling for Automatics
P3	Clinic on Improved Milling Practice
P4	Inspection Ways and Means
P5	Workholding Ways and Means

A complete bound set of ASTE 1954 Collected Papers, including all technical papers and panel discussions as listed above, will also be available after August 15, 1954.

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A drill press makes money only when the tool is cutting. Each second the spindle stands idle is a dead load on overhead.

Unfortunately, actual machining time in drilling, tapping, reaming or counterboring is pretty well fixed by the nature of the tool and material.

But the time taken in getting the tool to and from the material and the material to and from the tool is pretty much up to the ingenuity of the tool engineer. It's here that costs can be cut — added profits made.

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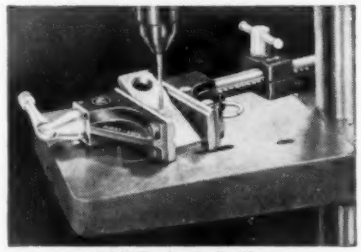


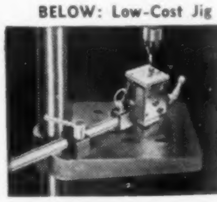
ABOVE: Angle Drilling

PREVENTS ACCIDENTS—This full-floating, securely anchored drill press safety vise holds work, including sheet metal, for drilling in many positions . . . keeps it from flying off the table.

CUTS JIG COSTS—Serves as base and instant-opening mechanism for low-cost jig . . . cuts jig parts and costs by as much as 80%.

SPEEDS SET-UPS — Ratchet-locking jaw slides instantly from maximum (9″ or 12″) opening to any position. A ¼-turn of the handle and screw-actuated jaw positively grips or releases work, including round stock.

BELOW: Low-Cost Jig



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Float-LOCK
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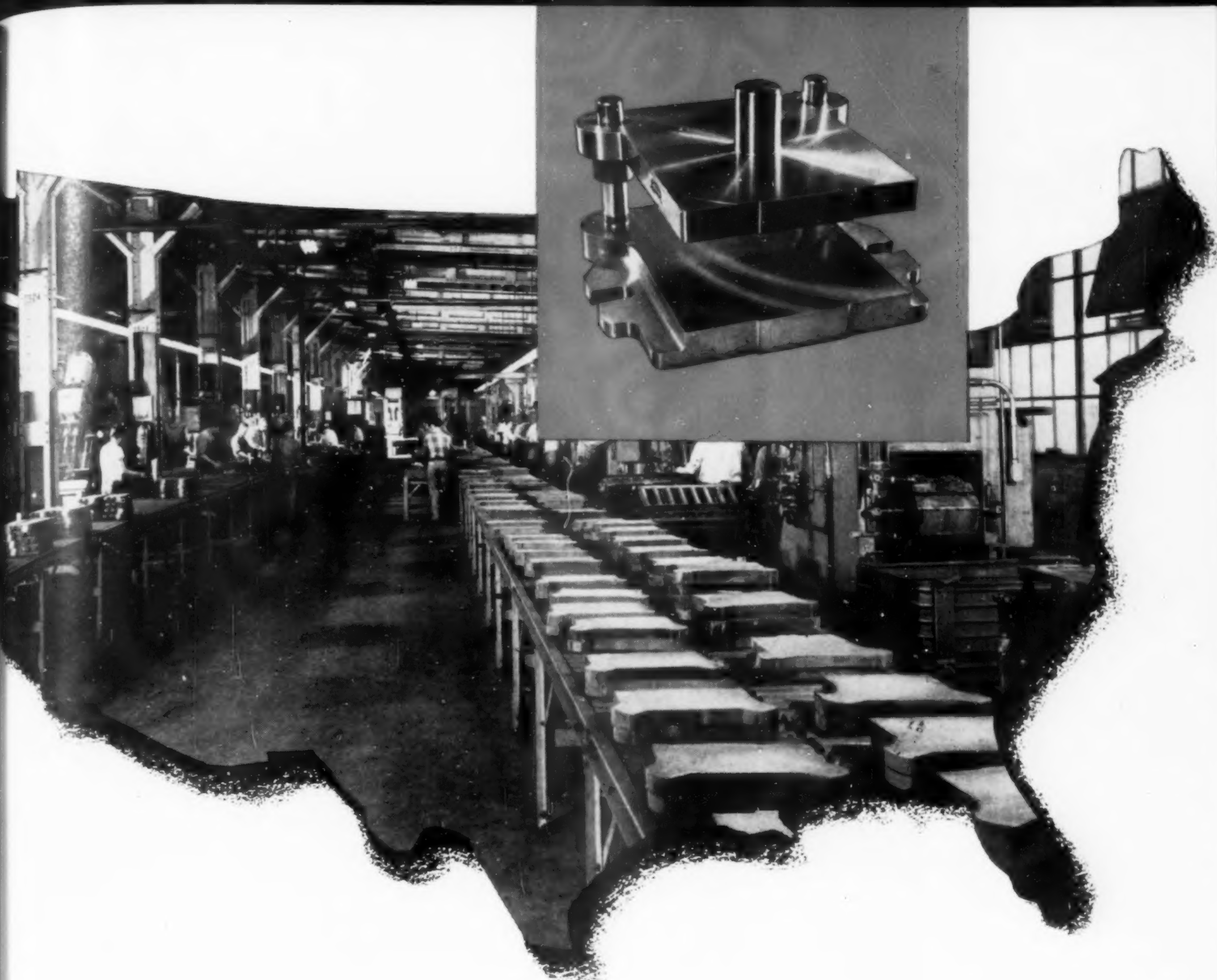

Here's the "how" of the fastest Die Set Service ever

FIRST, Danly is able to apply mass-production efficiency in manufacturing high precision, *interchangeable* die set components to the traditional Danly quality standards. **SECOND,** each Danly Branch is stocked with thousands of these *interchangeable* die set components, for immediate assembly to meet your tooling requirements. **THIRD,** Danly Branches are strategically located throughout the United States in major toolmaking centers to give you quick, local delivery. So, when you want the finest die sets in the shortest time . . . just call your nearby Danly Branch.

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HIGH SPEED, SENSITIVE
MULTI-DRILLERS
and TAPPERS
In Plastics
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In Cast Iron
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In Steel
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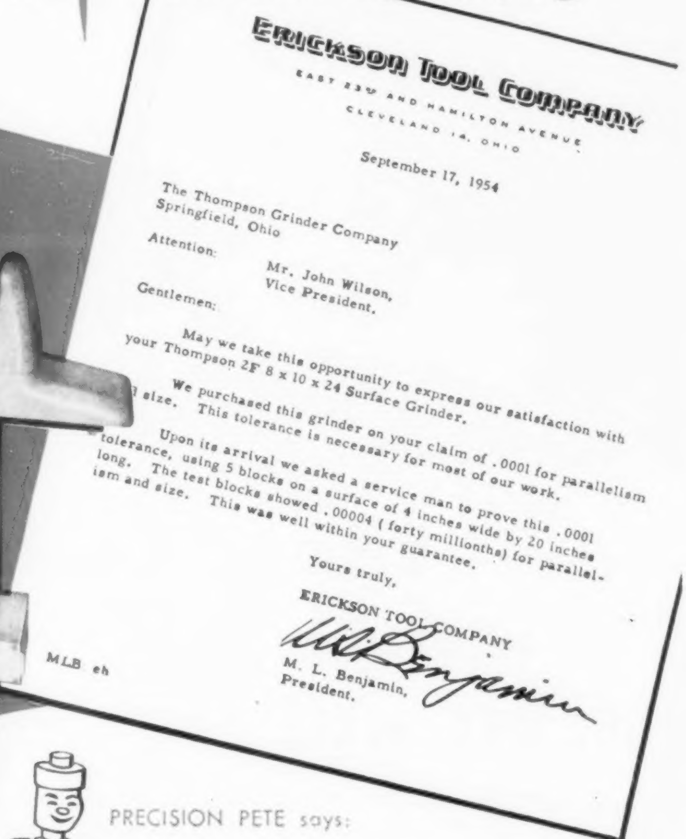
NATCO
H-5 and H-6
STANDARD AND HEAVY DUTY
MACHINES
(H-6 Machine Illustrated)

The Erickson Tool Company

asked for at least .0001 for parallelism and size. . .

The Thompson 2F (8x10x24) Super Precision Grinder

provided "forty millionths"



ERICKSON TOOL COMPANY
EAST 23RD AND HAMILTON AVENUE
CLEVELAND 14, OHIO

September 17, 1954

The Thompson Grinder Company
Springfield, Ohio

Attention: Mr. John Wilson,
Vice President.

Gentlemen:

May we take this opportunity to express our satisfaction with your Thompson 2F 8 x 10 x 24 Surface Grinder.

We purchased this grinder on your claim of .0001 for parallelism [illegible] size. This tolerance is necessary for most of our work.

Upon its arrival we asked a service man to prove this .0001 tolerance, using 5 blocks on a surface of 4 inches wide by 20 inches long. The test blocks showed .00004 (forty millionths) for parallelism and size. This was well within your guarantee.

Yours truly,

ERICKSON TOOL COMPANY

M. L. Benjamin,
President.

MLB eh

PRECISION PETE says:

"You may be surprised to find that Thompson 2F Grinders cost less than some others and still provide all these features for greater accuracy and longer service. Fast delivery, too!"

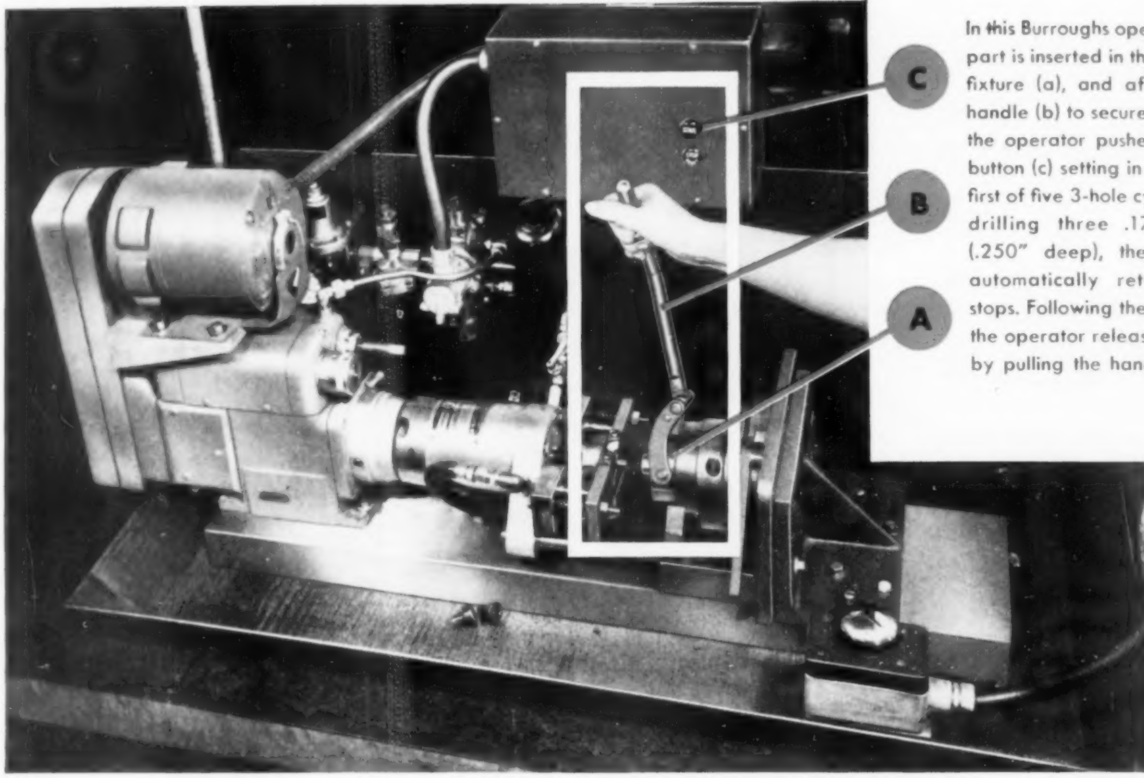
"Erickson products are sold and guaranteed to hold extreme accuracy. It is vital that we have the precision equipment necessary to manufacture these products. Our Thompson 2F Grinder delivers this precision. In the above picture we are grinding a #1200 expanding sleeve and hold within .0001 parallelism and size."

- **HARDENED AND GROUND** cross slide ways completely sealed.
- One shot lubrication to cross slide ways and internal saddle bearings.
- **HARDENED AND GROUND** sealed anti-friction vertical slide.
- **HARDENED AND GROUND BED WAYS** with automatic lubrication.
- 3600/1800 R.P.M. 2 speed wheel head. Heavy alloy steel spindle heat treated, runs in super precision ball bearings accurately preloaded, lifetime lubricated.
- Handy control panel.
- Elevation micrometer stop graduated in .0001"
- **GROUND THREAD FEED SCREW.**
- Automatic wheel **TRUING** device.
- Longitudinal hand feed with automatic engagement.
- Hydraulic head movement throttle with rapid traverse.
- Hydraulic table movement throttle.
- Elevating hand wheel graduated in .0005".

Call, write or wire for estimate

Thompson Grinders

THE THOMPSON GRINDER COMPANY • SPRINGFIELD, OHIO



In this Burroughs operation the part is inserted in the indexing fixture (a), and after pulling handle (b) to secure the piece, the operator pushes the start button (c) setting in motion the first of five 3-hole cycles. After drilling three .172" holes (.250" deep), the drill unit automatically retracts and stops. Following the fifth cycle, the operator releases the part by pulling the handle.

Labor Costs Plunge

. . . as Burroughs ups parts production 1200.6%

with Rockwell* Air-Hydraulic Drill Units

Costs cut to a minimum, and rejects eliminated—that's the record of just one of several Rockwell Drill Unit installations at the Burroughs Corporation Detroit plant.

Under previous hand-fed milling machine methods of drilling 15 tiny overlapping holes, production of clutches for Burroughs *Sensimatic* Accounting Machines had been limited to only 8 pieces per hour.

PRODUCTION JUMPED TO 101 PIECES PER HOUR, however, when Burroughs installed a simple, inexpensive Rockwell Drill Unit set-up.

And because of the completely automatic cycling of the Drill Units, only a few seconds of the operator's time is required—leaving her free for adjacent work and reducing the labor cost of this operation to practically nothing.

In plant after plant, special machines incorporating Rockwell Drill Units are shrinking high labor and material costs. Talk to your Authorized Sales Engineer about cost-cutting possibilities in your drilling, tapping, counterboring and kindred operations. He not only offers engineering counsel, but can also demonstrate right in your plant. Send the coupon today for his name.

Air-Hydraulic

DRILL UNITS

ROCKWELL

Another Product by ROCKWELL

*Originally produced by Rockwell under the trade name "Delta."

Drill Unit Division, Rockwell Manufacturing Company
306M North Lexington Avenue, Pittsburgh 8, Pa.

☐ Please send name of nearest Authorized Sales Engineer

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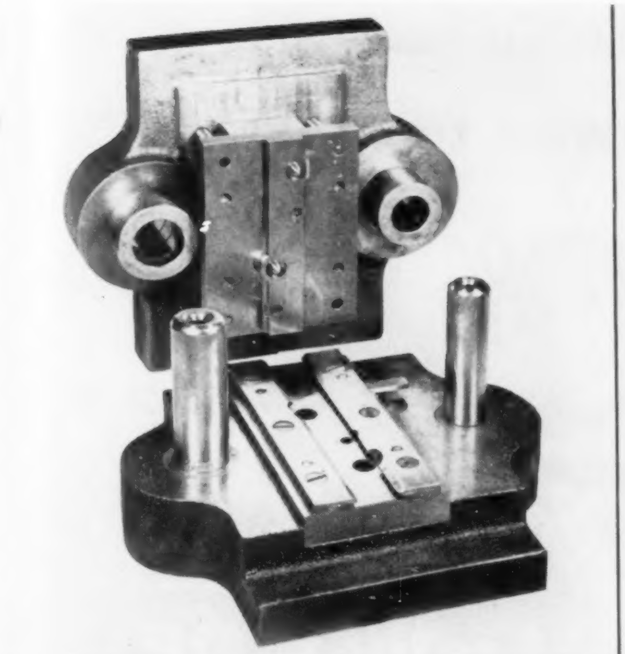

Simple progressive washer die, used at Precision Spring Company, Detroit, Michigan, pierces and blanks spring-tempered steel washers. With millions of accurate hits per sharpening, this die builds profits by cutting costs.

Complex lamination die punches two high-silicon "L" laminations per stroke. Dies of this type are in use throughout the metal-working industry, outwearing and outproducing steel dies by up to fifty times.

Dies equipped with CARBOLOY® CEMENTED CARBIDE increase production from 10 to 50 times

Over a wide range of applications, Carboloy cemented carbides have proved their superiority to steel by increasing production and cutting costs.

Here are some of the actual results achieved when users of large and small, simple and complex dies, switched from steel dies to dies equipped with Carboloy cemented carbide:

Lamination die. With Carboloy cemented carbide, production runs averaged 35 times longer than possible with steel.

Pierce and cutoff die. At 400 strokes per minute, carbide - equipped dies produced 2,000,000 strokes without resharpening.

Blanking and drawing die. Carbide-equipped die lasted months before resharpening. Steel required maintenance every week.

Deep drawing die. With Carboloy cemented carbide, manufacturing time per 100,000 pieces was slashed from 70 hours to 52 hours.

Explore the possibilities of using Carboloy cemented carbides in your dies. Carboloy engineers will give you or your die-maker every possible assistance. And, you can have your key men trained at the Carboloy Die School in Detroit.

Carbides are simple to use, easy to maintain. They'll pay for themselves through increased production, fewer rejects, reduced downtime and higher quality.

For complete information or for free Carboloy Die Engineering Manual, send coupon, today.

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Department of General Electric Company
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- ☐ Rush me free Carboloy Die Engineering Manual D-124.
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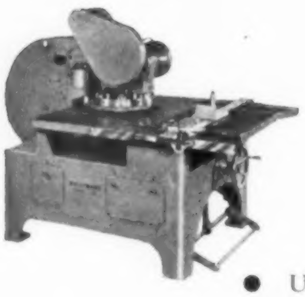
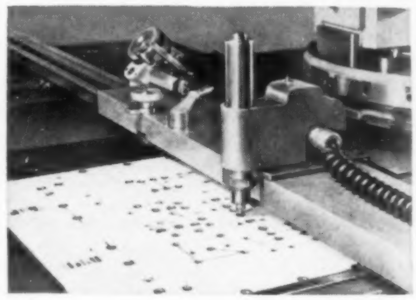
The RA-41P Turret Punch Press
Pays for itself in 2 YEARS or LESS



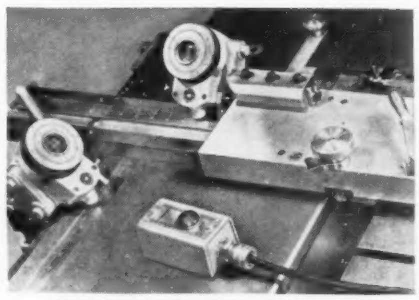
Save 90% on PIERCING

- Unmatched for high speed, low cost duplication of intricate hole patterns in flat sheet metal—low to medium production quantities.
- 18 or 20 punches and dies in turrets ready for use.
- Hole locations are made to a color-coded template—50 or more holes per minute.



Save 90% on TEMPLATE MAKING

- Press can be supplied with optical dimensioning instruments for template making.
- These templates are used with the RA-41P as well as for other applications. Drill jigs, prototypes, etc. are also produced to a tolerance of ±.002″ in 10% of the time usually required.



Wiedemann ships each press tooled—ready to produce your parts as soon as the machine is leveled and connected to your power line.

Wiedemann engineers will be pleased to study your drawings and show how these savings can be yours.

Write for a copy of Bulletin 241

WIEDEMANN MACHINE COMPANY

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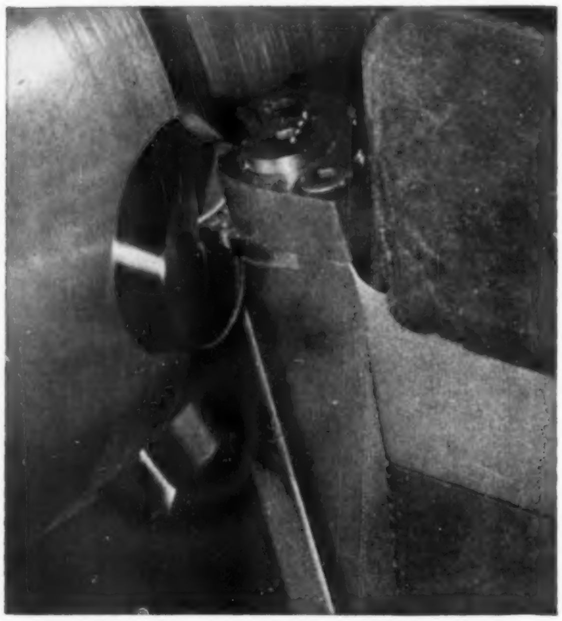
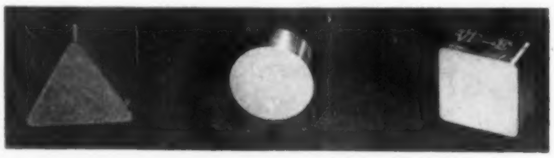
A NEW CONCEPT IN MACHINING WITH CARBIDE



New Vascoloy-Ramet Toolholder with "Built-In" Carbide Chipbreaker in operation. V-R Toolholders are made for Full Length, "Half-Length" and "Throw-Away" Length Inserts.

Machining with carbide has been synonomous with progress. Now, another milestone in the progress of carbide machining has been reached with the development of the New V-R Toolholder and New "Throw-Away" Blanks. One of the most serious problems in carbide machining has been the problem of carbide grinding, both chipbreaker grinding and re-grinding of the carbide after it has been in service. As an answer to these carbide grinding problems the Vascoloy-Ramet Corporation has developed a new Toolholder System which completely eliminates all carbide grinding. The New V-R Toolholder System consists of Toolholders for Triangular, Round and Square blanks and New "Throw-Away" blanks . . . blanks which are so economical they can be used in the Toolholder for machining operations and then thrown away.



Triangular, Round and Square precision "Throw-Away" Blanks for V-R Toolholders. Precision "Throw-Away" Blanks are ground all over and are used where precision indexing is desired. Utility "Throw-Away" Blanks, ground on two faces only, are also available in Triangular and Square Blanks.

The combination of New V-R Toolholders with their "Built-In" carbide chipbreaker and New "Throw-Away" blanks offers tremendous savings.

Compare the cost per cutting edge of a brazed tool based on: 1. Original Cost of the Tool. 2. Cost of Each Re-grind. 3. Number of Regrinds obtainable . . . Against the cost per cutting edge of V-R "Throw-Away" Blanks.

$$\frac{\text{Brazed Tool Cost} + (\text{Number of regrinds x cost per grind})}{\text{Number of regrinds} + 1 \text{ (for original tool)}} = \text{Cost per cutting edge}$$

Example:

$$\frac{\$2.40 + (6 \text{ x } .45)}{6 + 1} = \frac{510}{7} = \$.73 \text{ Cost Per Cutting Edge for a Brazed Tool.}$$

Compare this \$.73 cost per cutting edge for a brazed tool with the 10¢ cost per cutting edge for a V-R ⅜" I.C. "Throw-Away" Blank and you have a savings of 63¢ per cutting edge. Multiply this 63¢ savings by the number of cutting edges and you have the savings resulting from using "Throw-Away" blanks in the V-R Toolholder.

Following is a case history which illustrates a new concept in machining with the New V-R Toolholder System. Material machined: 12" diameter, ⅜" wall, SAE 1020, 4' length of C.W. welded steel tubing. This 12" diameter tubing is being run at 762 RPM or about 2,392 Surface Feet Per Minute. The depth of cut is .100" and the feed is .021". Machining time is 4 minutes. New Utility "Throw-Away" Blanks in the New V-R Toolholder are now being used to do this machining.

New V-R Toolholder with "Built-In" chipbreaker plate. For use with "Throw-Away" Precision or Utility "Throw-Away" Blanks.

Figuring machining time at approximately 10¢ per minute in that area and using a machining time of 5 minutes it costs 50¢ to machine one piece using the V-R Toolholder System.

Style BR Brazed Tool formerly used in this machining operation.

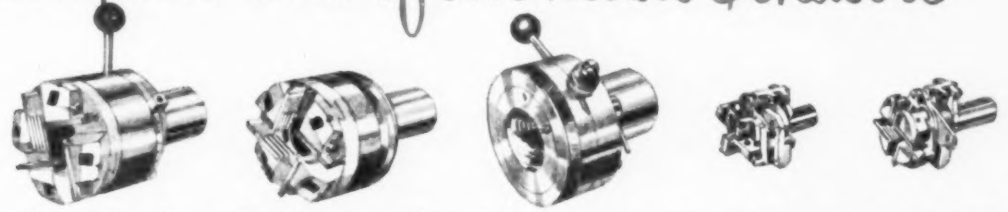
Previous machining time with carbide brazed tools was 30 minutes giving maximum tool life. (This can be considered normal for single point tools). Using the cost for machining time at 10¢ per minute it costs about \$3.00 in machining time alone using brazed tools as compared to a cost of 50¢ using the New V-R Toolholder system. Naturally at speeds of 2,300 feet per minute you cannot expect tool life, but when a "Throw-Away" ⅜" I.C. Triangular Blank can be purchased for 58¢ or roughly 10¢ per cutting edge, why shouldn't 10¢ be spent to earn \$2.50 additional?

Even greater savings than those calculated result, because there is no carbide grinding with the V-R Toolholder system. Formerly if one brazed tool would give 20 pieces per grind while another would give 25 pieces, naturally, the latter tool was preferred. Up to the present time tool life has always been the goal. Now, however the "Tool" becomes expendable and "Time" becomes important. Further information on this new concept in machining including cost comparison cards to be used in calculating specific brazed tool—"Throw-Away" Blank costs and information on the new V-R Toolholder System may be obtained by writing the

VASCOLOY-RAMET CORPORATION
854 Market Street
Waukegan, Ill.

Jones & Lamson offers...

a complete line of die heads & chasers



Automatic opening tangent stationary and revolving types, radial stationary type, B&S and small turret lathe types

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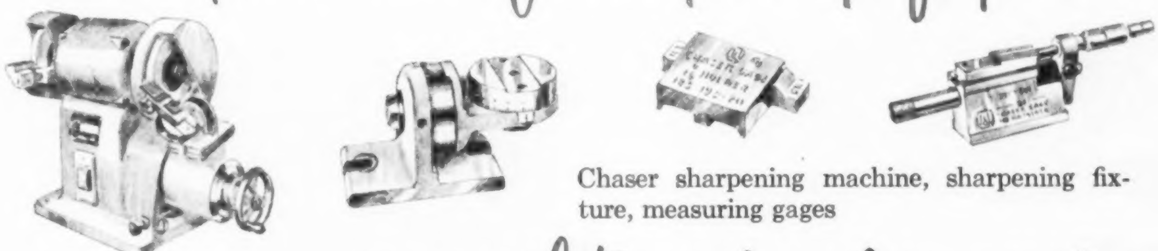
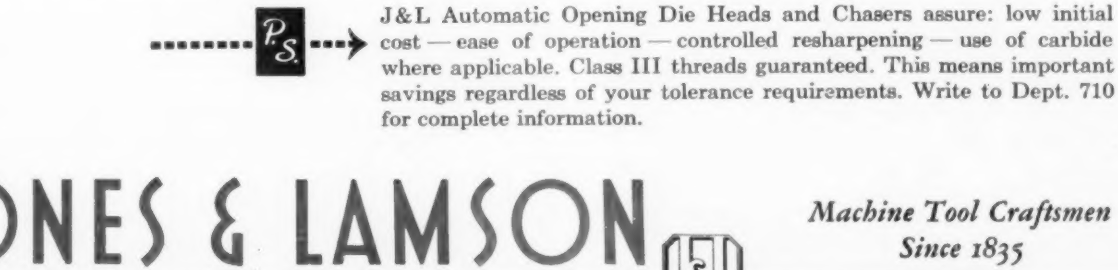


Chaser sharpening machine, sharpening fixture, measuring gages

a complete engineering service



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P.S. J&L Automatic Opening Die Heads and Chasers assure: low initial cost — ease of operation — controlled resharpening — use of carbide where applicable. Class III threads guaranteed. This means important savings regardless of your tolerance requirements. Write to Dept. 710 for complete information.

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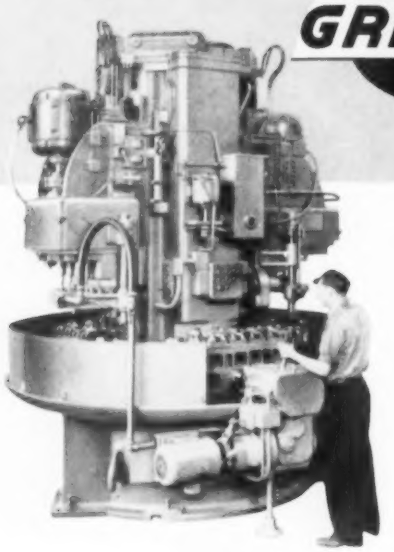

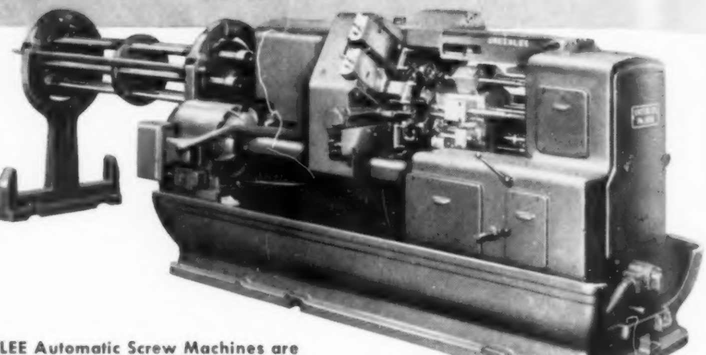

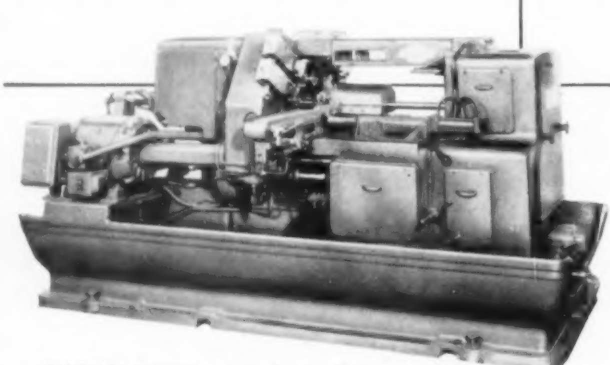

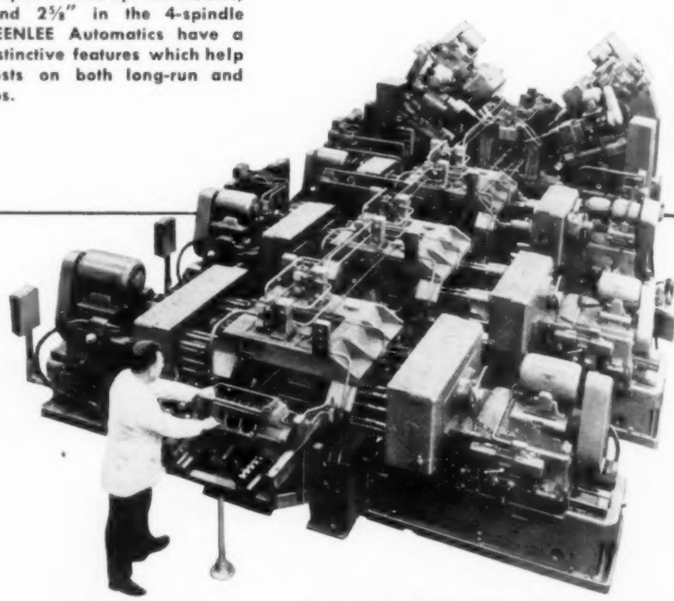

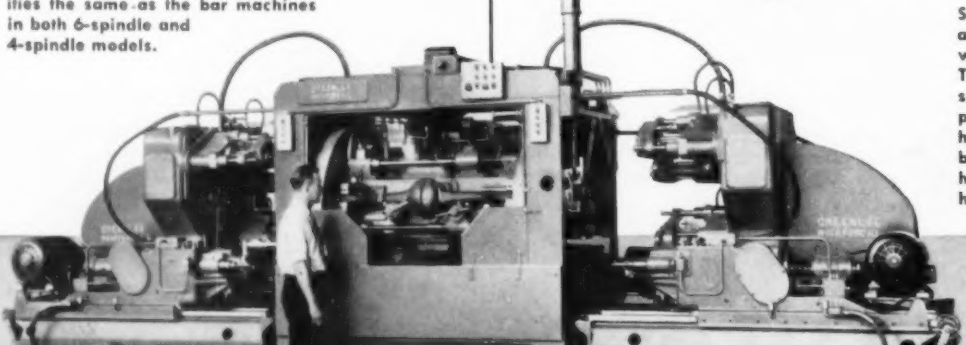

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the broaching surface cuts its own bearing points and makes

HOLE COSTS LOWER

The broach-fit bushing will locate itself permanently in holes which vary from −.001 to +.002.

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Simple tools can securely assemble Merriman bushings on the job.

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without the use of locking screws.

REPLACEMENT SIMPLIFIED

The Merriman broach-fit bushing may be removed and replaced as many as eight times without re-working the hole.

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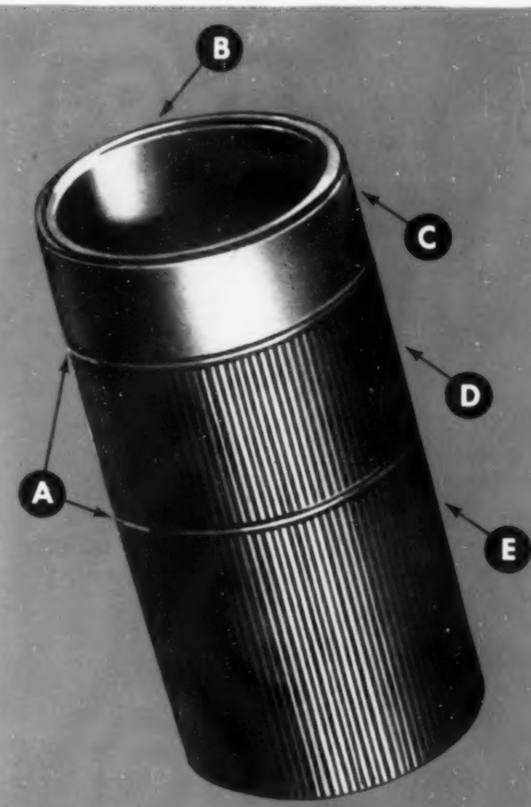

- **A** CHIP RETAINER GROOVES—sized to handle all excess displaced metal.
- **B** THIN WALL CONSTRUCTION—reduces weight and permits the use of smaller reamed holes. Also available in thick wall construction.
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All bushings are made of HARDENED STEEL and treated with BLACK OXIDE PENETRATE to prevent rust and corrosion.

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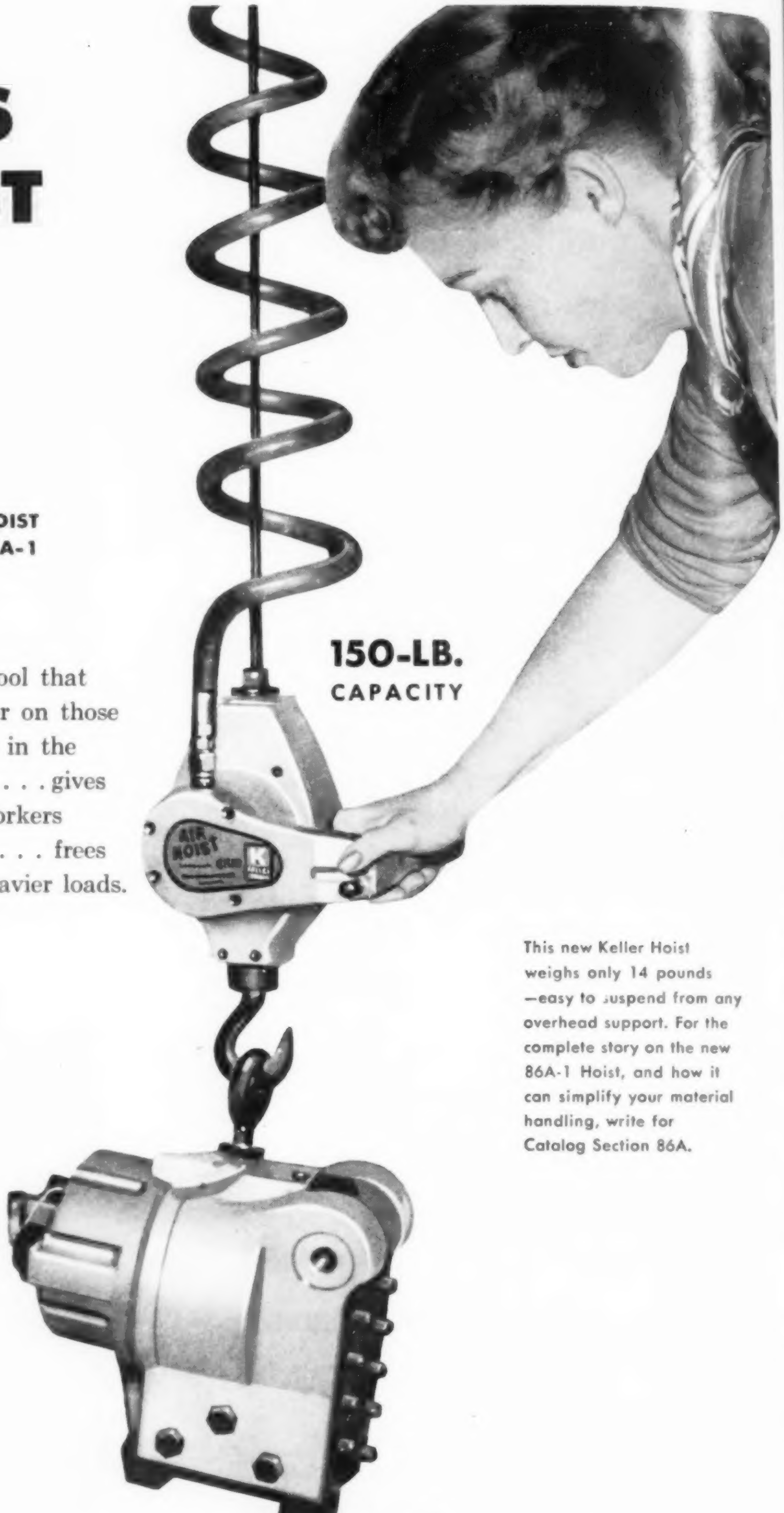
- Pull it down
- Hook on load
- Run load up

KELLER AIR HOIST
SIZE 86A-1



Here is an entirely new lifting tool that saves time and manpower on those troublesome handling operations in the 50- to 150-pound range . . . gives added strength to production workers for repetitive lifting jobs . . . frees larger hoisting equipment for heavier loads.

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- One-hand control—operator can reach out, pick up, and place 150-pound load with one hand.
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This new Keller Hoist weighs only 14 pounds—easy to suspend from any overhead support. For the complete story on the new 86A-1 Hoist, and how it can simplify your material handling, write for Catalog Section 86A.

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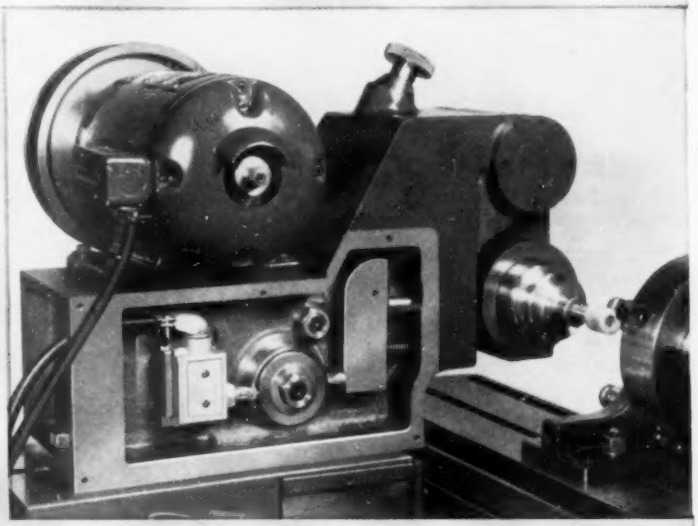

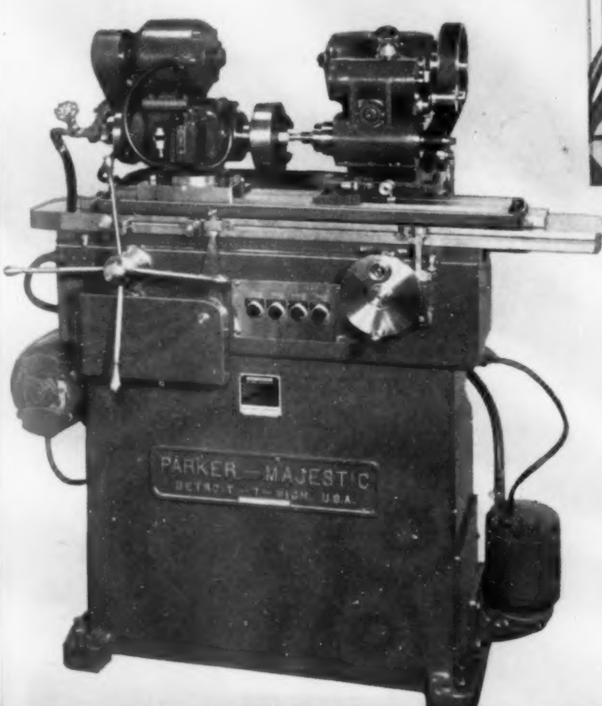

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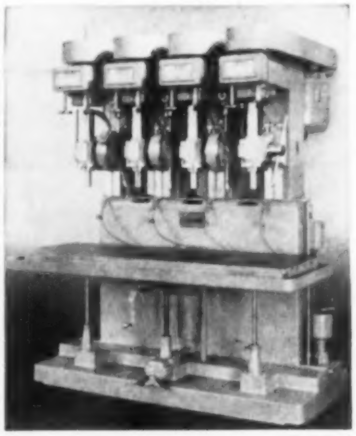

Illustrated is a Leland-Gifford No. 3-MVB Four Spindle Drilling Machine equipped with a Ruthman Pump.

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GUSHER coolant pumps

Based on performance Gusher Coolant Pumps are economical in initial price . . . economical in operation. They give split second coolant flow—use less power when throttled—require a minimum of maintenance. Pre-lubricated heavy-duty ball-bearings and an electronically balanced rotating shaft assembly guarantees long trouble-free life for your Gusher Pump. *Write for catalog today.*

THE RUTHMAN MACHINERY CO.
1810 READING ROAD CINCINNATI, OHIO

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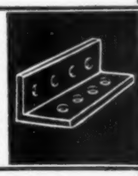
First and Foremost **NOBUR'S** *Job Tested* **TEAM** *for* ★ **DEBURRIN** ★ **CHAMFER G**

the **NOBUR**

for machi deburring nd chamfering f line-drilled nd otherwise inaccessibl hole surfa

for the automatic deburring and chamfering of front and back hole faces simultaneously in sheet metal, etc.



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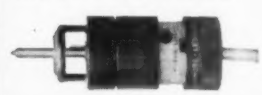

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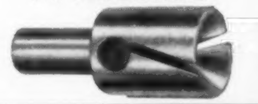

for rapid deburring and chamfering the outer ends of rods, tubes and bosses.

for rapid deburring and chamfering openly accessible hole faces.

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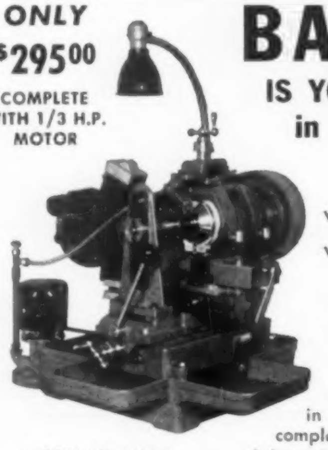

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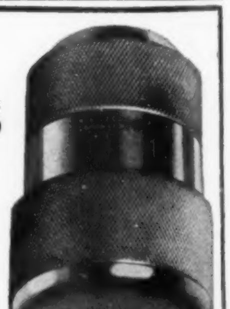

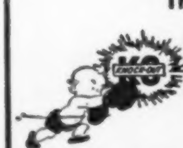

K. O. LEE CO.
ABERDEEN, S. D.

If it's made by **Lee** *it's a* **"Knock-Out"**

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. . is proud to reproduce this unsolicited advertisement by American Type Founders as it appeared in nationally circulated technical magazines.

This machine hunts for—and finds—dead center!

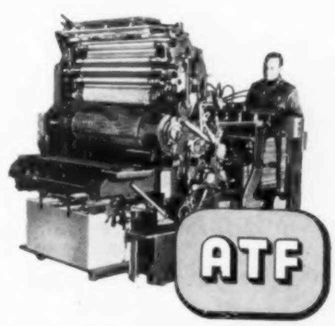
This De Vlieg Jigmil is used to locate and bore the cylinder, gear-driven ink rollers, and gear bearing holes in ATF Chief frames.

Once the adjustments have been set, the Jigmil automatically positions every subsequent frame by moving its machine table or spindle head until the desired center is located to within 3-5/10,000ths of an inch. Then this 12-ton precision borer is micrometer-set so accurately that it will remove a pencil mark from a boring without cutting the metal.

Bearing holes not so accurately located on the press frame could easily throw cylinders out of parallel, cause excessive wear to precision gears, make smooth high-speed operation impossible and take years off the productive life of a press.

That's what we mean when we talk about the precision engineering that goes into an ATF Chief. You won't find more accurate borings in any press regardless of price. It's like getting Cadillac construction for Chevrolet prices.

It will pay you well, next time you're in the market for a small offset press, to ask for the full story on the precision-engineered ATF Chief. Write AMERICAN TYPE FOUNDERS, *a subsidiary of Daystrom, Inc.*, 200 Elmora Avenue, Elizabeth, New Jersey.



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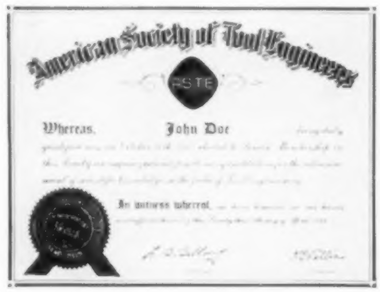

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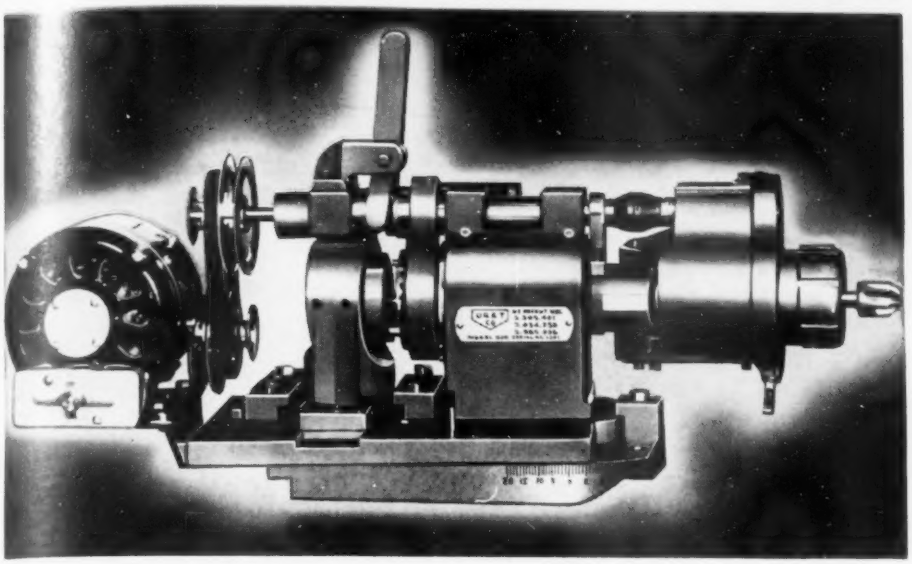
Precision CIRCULARITY GRINDING ATTACHMENT



Simple, speedy set-ups on this accurate attachment permit fast and easy grinding of form relief, radial relief, form and radial relief together, tapered cylindrical and straight cylindrical. Cutting tool to be produced or reworked is held in collet or between dead centers and revolves on its own axial center. Where full length of spiral cutting tools is to be ground for both form and radial relief, the Circularity Grinding Attachment travel is similar to an O.D. grinder, which insures fine finish, back taper and accurate size.

The Detroit Reamer & Tool Company Model 500 Circularity Grinding Attachment shown above is faster, easier to handle, has positive control, greater adaptability, rugged construction, and is engineered and precision built to provide the finest in precision work. Therefore, it will be of invaluable assistance to anyone whose tooling standards must meet modern production requirements.

You Can Grind Tools Like These

***on a* DETROIT REAMER CIRCULARITY GRINDING ATTACHMENT**

Special Cutting Tools of DEPENDABLE QUALITY

The Detroit Reamer & Tool Co. Plant is equipped with the finest in modern machinery and inspection facilities to provide you with the ultimate in precision tools. Our Engineering and production personnel with 35 years of empirical knowledge behind them are completely qualified to expertly handle your tool needs. For dependable cutting tools—specify Detroit Reamer & Tool Co.

DETROIT REAMER & TOOL CO.

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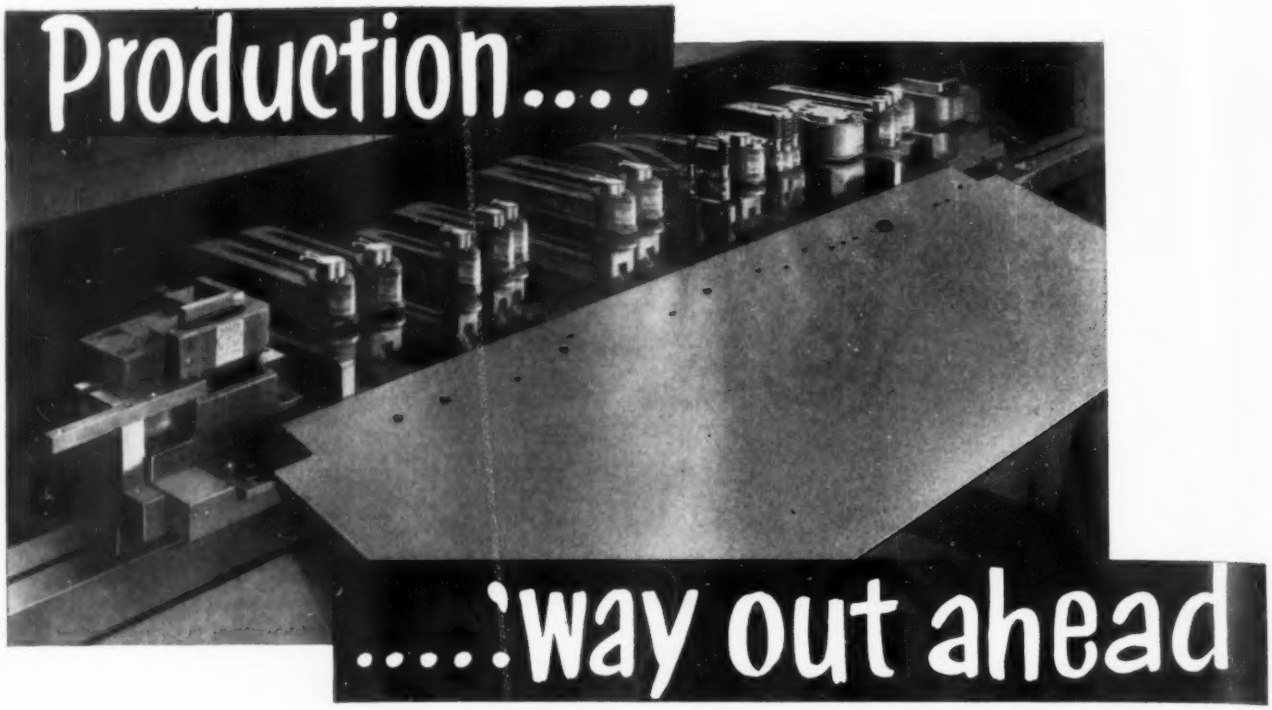
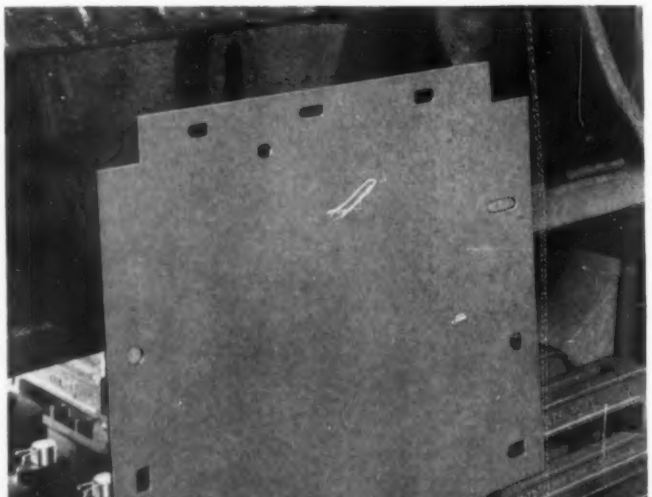
DR &T COMPANY



WALES HOLE PUNCHING & NOTCHING EQUIPMENT



TOP — Wales Type "BL" Hole Punching Units and Wales Type "N" Notching Units in a combination staggered hole punching and notching set-up in a press brake.

BOTTOM — Typical round and shaped holes plus corner notches produced by Wales Type "BL" Hole Punching Units and Type "N" Notching Units in a stamping press.

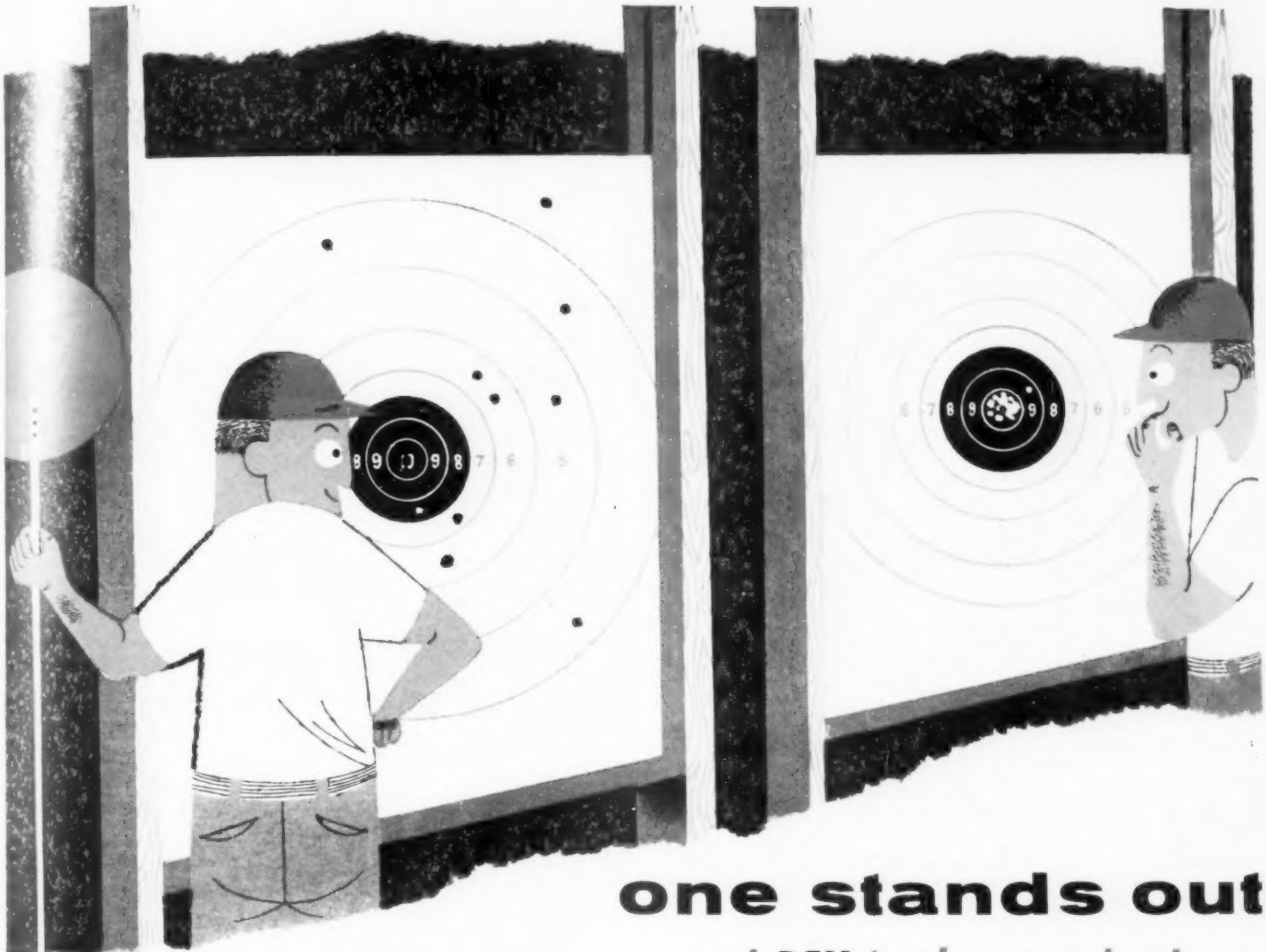
By providing simpler, faster set-up methods, Wales Hole Punching and Notching Units *insure greater production economies.*

For example, a group of these independent, self-contained Wales Units may be set up for punching and notching to produce parts the same day a pattern is released for production. These "Right-Into-Production" advantages are made possible by proven Wales features:

- ▶ Nothing attached to press ram
- ▶ Punches and dies always in perfect alignment
- ▶ No die set required
- ▶ Independent and self-contained
- ▶ Set up in press brakes and stamping presses on templates, T-slotted plates or press brake rails
- ▶ Uniform shut height requires only one ram adjustment
- ▶ Units may be used in unlimited set-ups eliminating "dead storage"

Before putting holes and notches in angles, channels, extrusions and sheets by *any* method, have the Wales facts at your finger tips. Write today for your personal copy of Wales BL catalog.

WALES-STRIPPIT CORPORATION
George F. Wales, Chairman
393 Payne Avenue, North Tonawanda, N. Y.
(Between Buffalo and Niagara Falls)
Wales-Strippit of Canada, Ltd., Hamilton, Ontario
Specialists in Punching and Notching Equipment



one stands out

...and **REX** is the standard by which all high speed steels are compared

It takes exceptional skill *and* experience to make consistent scores on the target range . . . or to produce consistently superior high speed steels.

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Once you've tried it, we think you'll agree — *you can't find a high speed steel that will outperform REX.*

CRUCIBLE first name in special purpose steels

54 *years of* Fine *steelmaking* **TOOL STEELS**

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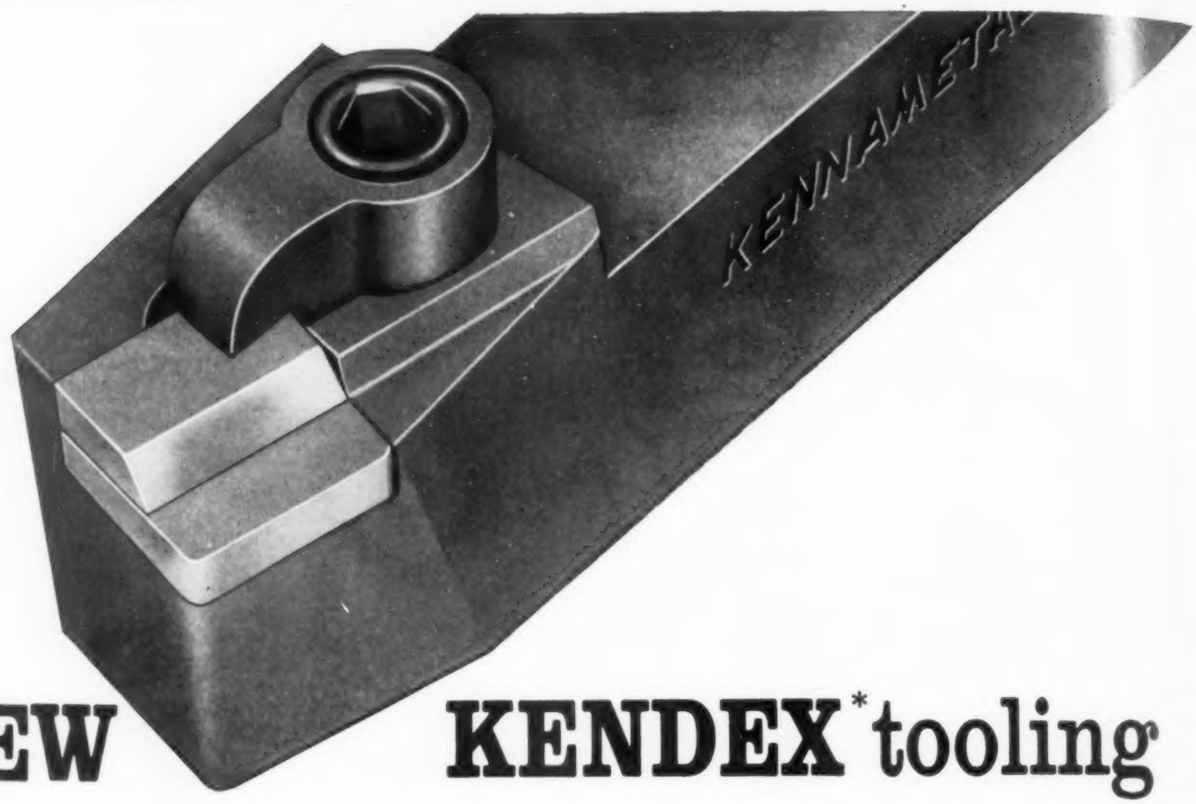


NEW KENDEX* tooling slashes cost per cutting edge

It's entirely new . . . everything except the long-established Kendex "throwaway button" principle pioneered and proved by Kennametal.

We took a good look at tool cost per cutting edge and designed a new Kendex with a clamp-on, "turnover" insert, plus a new system of chip control. This combination eliminates all regrinding, doubles the usable cutting edges per insert, and slashes tool cost on all types of machining operations. For example: On one job, tool cost was cut from $1.13 to $0.06 per piece.

NEW "TURNOVER" INSERTS

The new "turnover" inserts are designed with cutting edges on both sides, and can be indexed in seconds. After all cutting edges are used on one side, simply turn them over and use an equal number on the reverse side. Square inserts have eight cutting edges; triangular inserts, six.

These cost-reducing inserts are available in two types: (1) Regular, ground on top and bottom with corner radii ground for indexing; (2) Precision inserts, ground on all sides for precision indexing. When all edges are used . . . replace the insert and eliminate regrinding.

The new Kendex comes in a range of sizes in two models—Standard and Heavy-Duty. The Standard model is available with either Regular or Precision inserts; the Heavy-Duty with Regular inserts only.

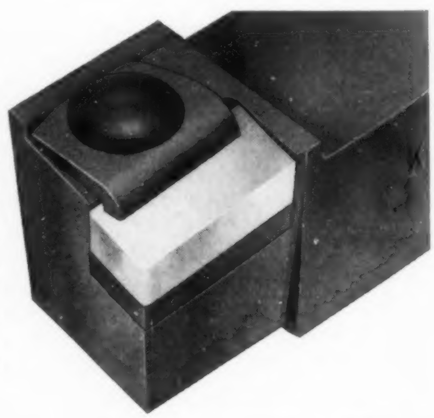
NEW CHIP CONTROL SYSTEM

The new Kendex design not only eliminates regrinding of inserts, but the grinding of chip breakers as well. Standard Kendex tools have replaceable carbide chip breakers which have the widest effective application of any mechanical chip breakers available. On many jobs, the chip breaker can be removed to prolong tool life. Heavy-Duty sizes (shown at right) are fitted with rigid, inexpensive spring clamps which serve as chip deflectors.

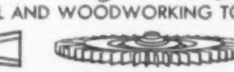
Replaceable, hardened steel shims (available on the larger shanks) prolong tool life, reduce tool maintenance, and eliminate grinding of holders in case of accident with the tool.

For complete information, call your Kennametal representative, or write KENNAMETAL, INC., Latrobe, Pennsylvania.

*Registered trademark



MINING, METAL AND WOODWORKING TOOLS



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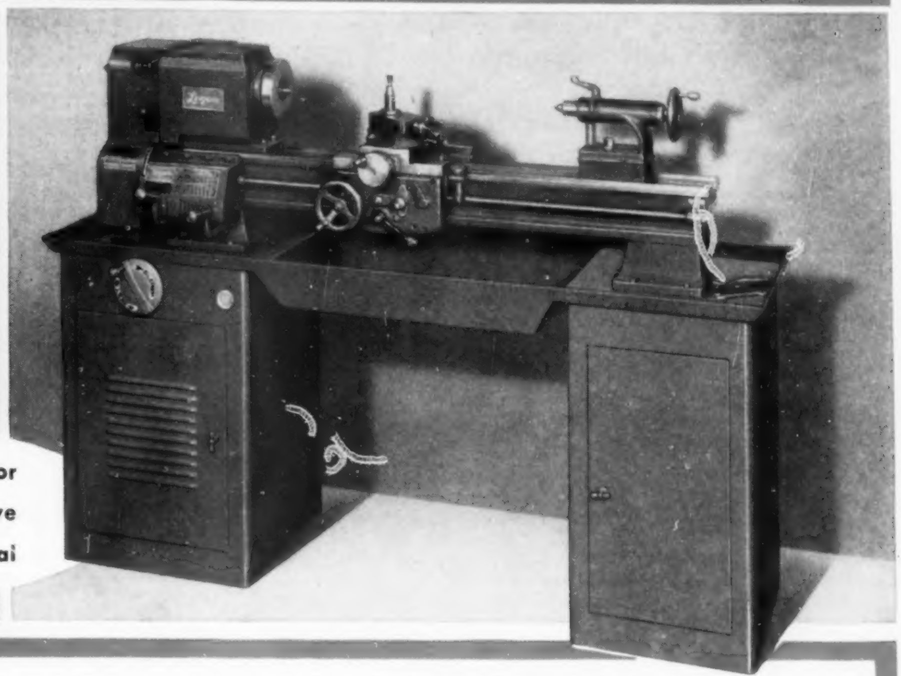
THE "2500" SERIES *Logan* 12" SWING LATHES

- 12" swing over bed
- 7¼" swing over saddle
- 1⅜" spindle hole
- 1" collet capacity
- 23" and 35" centers

Variable Speed Drive or Standard Double V-Belt Drive optional



Precision Built, Extra Heavy For Smooth, Powerful, Quiet Operation

Seeking ways to build better lathes is one project Logan never finishes. Now, in the "2500" series, Logan's continuous improvement program has produced a smoother running, more rugged line of 12" lathes. Extra strength is distributed through wider gears, larger shafts, heavier bearing supports, heavier base and at other points where more weight means more power, more smoothness and a minimum of vibration.

Advanced design and more precise construction are in evidence throughout these improved lathes. The precision carriage rides on a two-V-way, two-flat-way bed that is rugged, rigid, precision-ground and warp-free. The massive special alloy spindle turns on a double-row of over-size ball bearings. No bearing adjustment is needed for any spindle speed within the wide rpm range. The result is sustained accuracy as well as smooth, quiet operation.

Offering economy in price and in operation, plus quality in results, the "2500" series lathes can well put new profits in most of your metalworking. Your Logan Lathe dealer has them. See them now.

LOOK TO LOGAN FOR **BETTER** LATHES AND SHAPERS

LOGAN ENGINEERING CO.

Lawrence and Lamon Avenue, Chicago 30, Illinois

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PRECISION INTERNAL GAGE

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in the Jet Engine and
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GAGES PRECISION HOLES TO FRACTIONS OF .0001"

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Write for complete details — TODAY!

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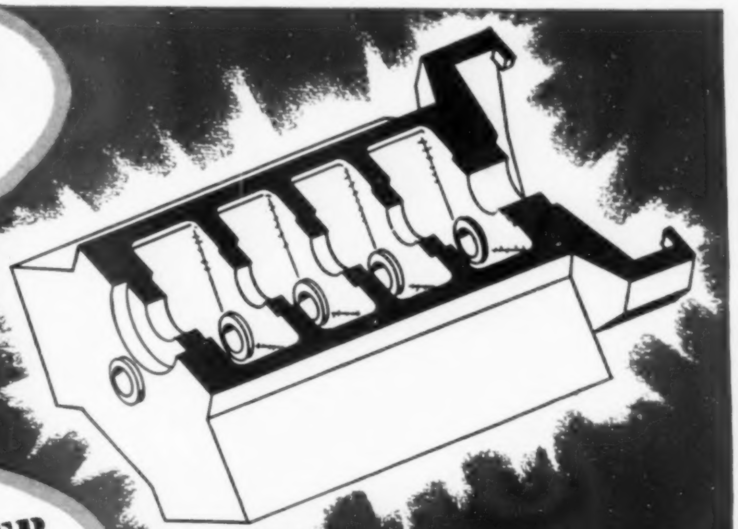
CUSTOMER SPECIFIED

To increase production of V-8 engine blocks, a large automotive manufacturer specified a close tolerance, production milling machine for rough and finish milling of pan rail face and bearing locks.



Solid areas indicate machined surfaces on V-8 engine block

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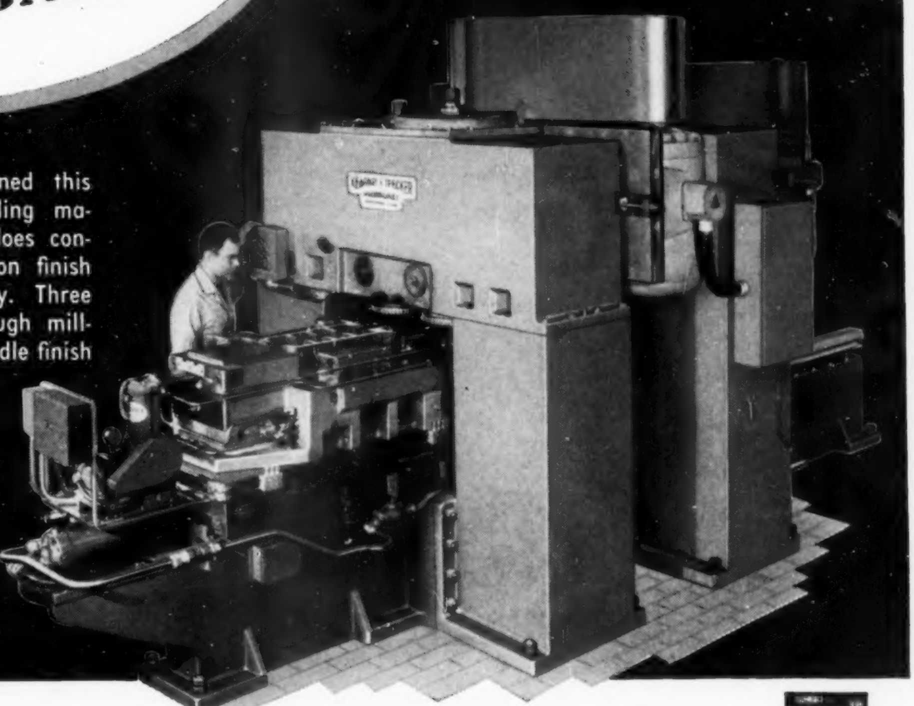

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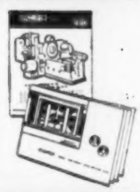

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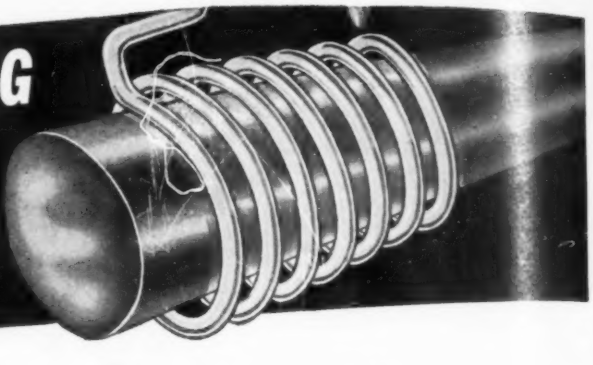

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The Tool Engineer

1954

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Clearing Machine Corp.
Cleveland Cap Screw Co., The
*Cleveland Cutter & Reamer Co.
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